ICU Management

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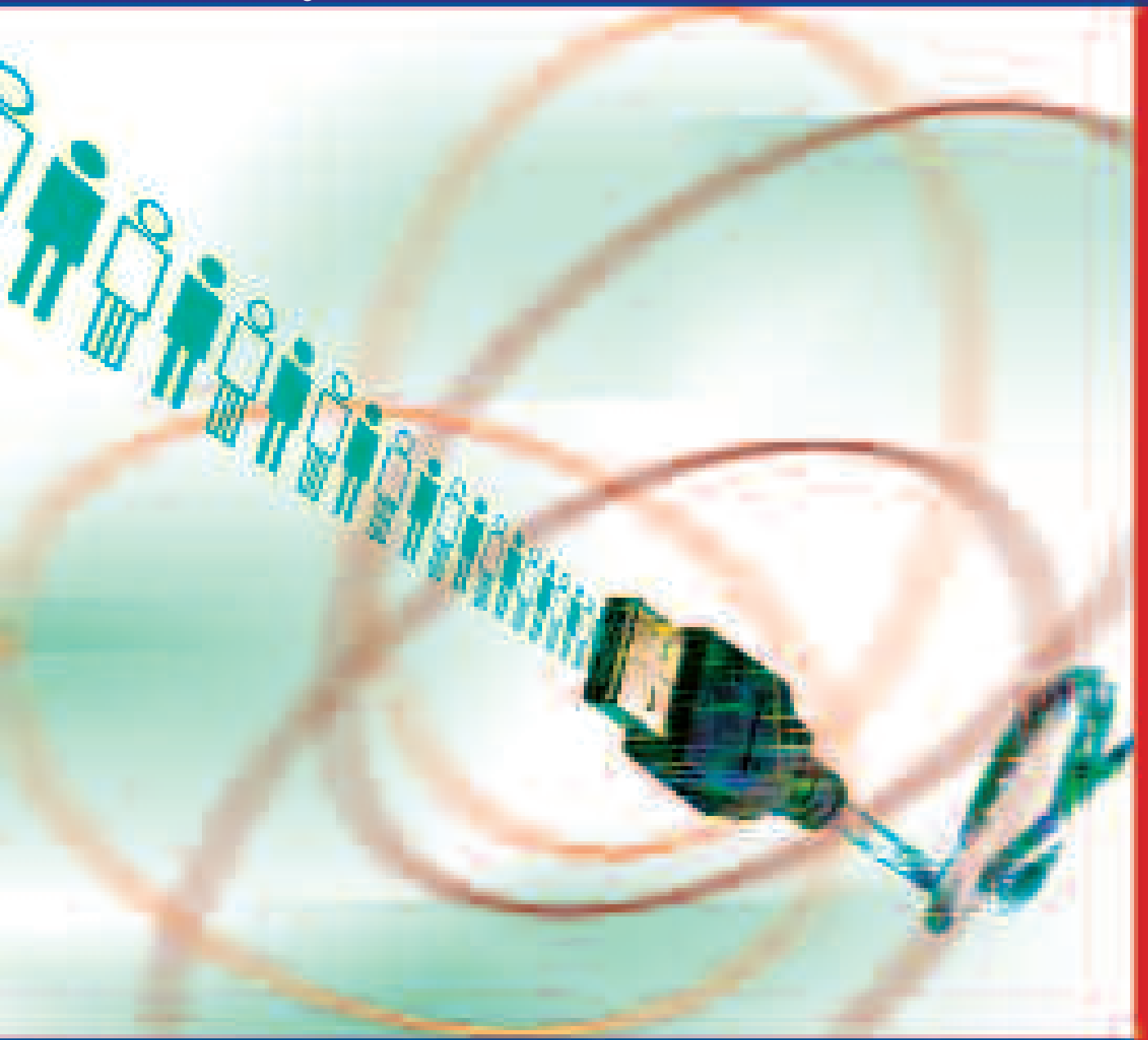

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Care with IT

Information technology has 'invaded' the intensive care unit at an astonishing rate over the last few years. Hand-held personal digital assistants (PDAs), patient databases, and clinical information systems are now widely used in many units, and telemedicine, and even robots, are being seen increasingly frequently in our ICUs. The advantages of PDAs, clinical information systems and patient databases are clear to see, including providing more rapidly available and reliable data on everything from bed occupancy to pathogen frequency to staffing patterns. Practicing medicine increasingly requires good data management as well as good patient management. Using computerized systems, with links to all areas of the hospital, results of laboratory, radiological, and other investigations can be available immediately, saving valuable time chasing the paper trail. Medical errors can also be reduced by the improved exchange of, and access to, information. Automatic reminders about abnormal results or potential drug interactions can improve patient management and limit the likelihood of error. As the ICU population increases in size, out of step with the numbers of available intensivists, telemedicine also has considerable appeal, not least to ensure at least some form of 24-hour intensivist cover, especially for smaller ICUs. Using such technology, intensivists can assess distant patients 'virtually', with full access to their online data and monitoring systems.

Information technology clearly has an important role to play in improving the effectiveness and efficiency of intensive care medicine, but ongoing development and acceptance may be limited by several factors.

First, the effects of such technology on patient outcomes need to be carefully assessed, particularly considering the high financial costs of creating and implementing medically applicable information technology. Second, many hospitals already have some computerized systems in place, but these are not standardized and may not even be able to interact with each other. Overhauling or replacing these more rudimentary systems is a complex, time-consuming and expensive process, but for such systems to work at their best they need to be able to function as an integrated whole, hospital-wide. Ideally, internationally accepted standards should be developed and used so that data can be transferred across international boundaries. Finally, information technology is still somewhat of an enigma to many ICU staff members, as well as to patients and their families. Although email and Internet are now used by many at home, the idea that similar technology could be applied and offer benefit to patient care is still a relatively new concept and, as with any other new development in medicine, will take time to become accepted and applied. Fears about patient privacy and even concerns about technology 'replacing' medical staff also need to be addressed as medicine adapts to the new era of information technology.

In this issue of ICU Management, we discuss some (of the many) applications and limitations of information technology in the ICU.

Jean-Louis Vincent
Head, Department of Intensive Care, Erasme Hospital Free University of Brussels, Belgium

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Pandemic preparedness and patient **safety**

Avian Influenza Action Plans

A global meeting between the World Health Organisation (WHO), the Food and Agriculture Organisation, the World Organisation for Animal Health and the World Bank, held 7-9 November 2005, defined an action plan to control avian influenza in animals and limit the threat of a human influenza pandemic. The H5N1 influenza virus is currently circulating in animals in Asia and has been identified in parts of Europe. Human exposure to the H5N1 virus risks the emergence of a new pandemic virus. In his opening speech on the 7th November, WHO Director General, Lee Jong-wook, distinguished between seasonal flu, avian flu and human pandemic influenza. Although he stated that there was no current outbreak of human pandemic influenza anywhere in the world, he warned "the signs are clear that it is coming. The 1918 pandemic resulted from a changed avian flu virus. Since its appearance in Hong Kong in 1997, highly pathogenic H5N1 avian flu has spread to 15 countries in Asia, and Europe." The World Bank estimates that the needs of affected countries could potentially reach US$1 billion over the next 3 years. The meeting was attended by more than 600 delegates from over 100 countries and concluded an action plan covering six key areas: control at source in birds, surveillance, rapid containment, pandemic preparedness, integrated country plans, and communications.

Source: www.who.int November 2005.

The need for critical care units and intensive care physicians to be closely involved in contingency planning at a national level has been highlighted recently in the UK. In an article in *Anaesthesia* in October 2005, Drs David Menon, Bruce Taylor and Saxon Ridley pointed out that an epidemic would result in an increased number of admissions, both to hospitals and to intensive care units, and criticised the Department of Health's "UK Influenza Pandemic Contingency Plan" for not considering the impact of a pandemic on critical care services. Dr Menon and colleagues (2005) modelled this potential impact for the UK, using software developed by the Centre for Disease Control and Prevention (www.cdc.gov/flu/flusurge.htm). Their study showed that for a 25% attack rate and 8-week pandemic duration, the demand for ventilatory support would exceed 200% of present capacity. Demand also remained unsustainably high in models with more favourable scenarios. The researchers concluded that current critical care bed capacity in England would be unable to cope with the increased demand provided by an influenza pandemic, highlighting the need for appropriate critical care contingency planning. Dr Bruce Taylor has now been asked to set up a UK Critical Care Contingency Planning group, which will plan for expansion of critical care capacity to meet this need.

Sources: Anaesthesia 2005; personal communication with Bruce Taylor, November 2005.

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World Alliance for Patient Safety

The Who World Alliance for Patient Safety comprises heads of agencies, policy-makers and patients' groups with the aim of advancing the patient safety goal of "First do no harm". Chaired by Sir Liam Donaldson, the Alliance launched the Global Patient Safety Challenge 2005-2006, "Clean care is safer care", in October 2005. The Alliance reports:

- that healthcare associated infection affects 1.4 million worldwide in hospitals at any given time,
- between 5% and 10% of patients admitted in modern hospitals in developed countries acquire one or more infections, and that
- the risk of healthcare acquired infection is 2 to 20 times higher in developing countries.

The Challenge tackles healthcare acquired infections, which promote drug resistance, increase costs and pose risks to patients, relatives and healthcare workers.

Sourced from www.who.int November 2005, where documents on actions of the Challenge and the "WHO guidelines on hand hygiene in healthcare" are available.

Patient Safety in Michigan

Michigan Health & Hospital Association's (MHA) Keystone Centre for Patient Safety & Quality has completed a 15 month project to improve ICU patient safety. *Keystone: ICU* is a collaborative of more than 120 Michigan ICUs and 70 Michigan hospitals. Using a predictive model and data collected from participants between March 2004 and June 2005, the total savings were estimated to be:

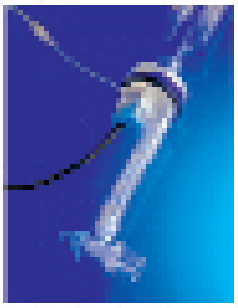
- Patient Lives Saved - 1,578
- Hospital Days Saved - 81,020
- Health Care Dollars Saved - $165,534,736

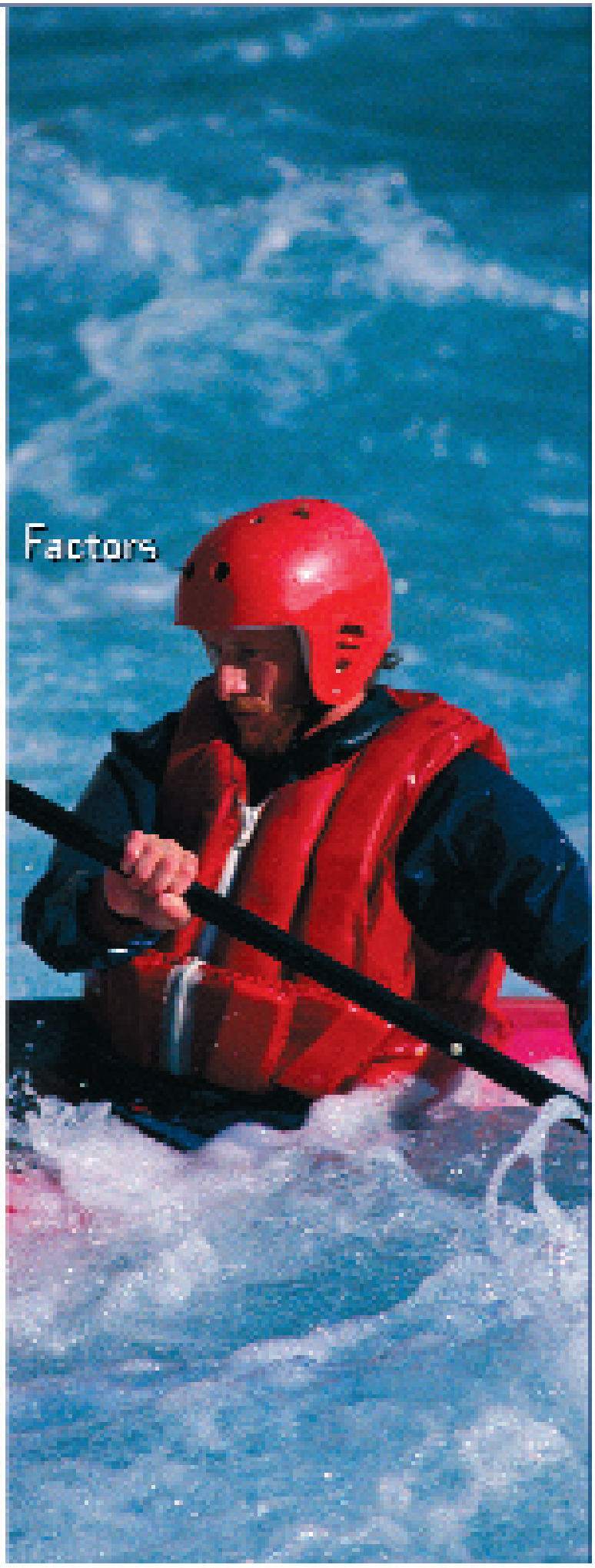
Central IV line infections were reduced by nearly 50%, 68 out of the 127 participating ICUs reported zero bloodstream infections or ventilator-associated pneumonias for six months or more, and overall ventilator associated pneumonia rates continue to decrease. MHA Keystone Centre was established in March 2003, and brings together hospitals, national experts and best practice evidence to improve patient safety. Co-leaders of the ICU project are Chris Goeschel RN MPA MPS, executive director of the MHA Keystone Centre, and Peter Pronovost MD PhD FCCM, internationally recognized patient safety expert from the Quality and Safety Research Group at Johns Hopkins University.

Source: www.MHAKeystoneCenter.org November 2005.

MEDISIZE

Critical Factors





Stem cell research

While preparation for the 7th European Framework research programme is currently under way, Euro MPs have called on the European Commission (EC) to stop financing stem cell research.

The EC is resisting attempts by a large group of Euro MPs to prevent EU financing of embryonic stem cell and therapeutic cloning research. The MEPs' move to cut off funding comes as national governments and the European Parliament (EP) are preparing to finalise the terms of the EU's multiannual framework programme, which will run between 2007 and 2013.

Under the existing programme, four research projects involving EU finance have been given the go-ahead to use human embryonic stem cells. They include fundamental geonomics research related to lymphatic vasculature, in vitro technology to study reproductive toxicology and the regeneration of beta cells to restore normal insulin production for diabetics.

The 73 MEPs, many of whom are German and Polish and come from the ranks of the centre right, have written to José Manuel Barroso, the EC President, reminding him of the stance that Parliament adopted earlier this year and asking him to stop the financing at the end of 2006. According to the resolution adopted in March, the EP asked the Commission "to apply the subsidiarity principle in connection with other forms of embryo research and embryonic stem cell research, so that Member States in which this kind of research is legal fund it from their national budget". The resolution also notes that "EU funding should concentrate on alternatives like somatic stem cell and umbilical cord stem cell research, which are accepted in all Member States and have already led to successful treatment of patients".

Within days, Barroso had sent his reply. He went out of his way to reassure the MEPs that their concerns were being taken into account as the Commission drew up the specific research programmes that flesh out the overall framework. He noted that the "nature of this subject and the rapid evolution of scientific knowledge imply that the door for debate is never closed". He confirmed that he would soon be asking the European Group on Ethics in Science and New Technologies to produce opinions on ethical questions connected with research policy with the aim of triggering further discussions.

But he pointedly refused to concede any change in existing practice, indicating that he and his colleagues are satisfied with the procedures in place. These require that any research proposals which raise ethically sensitive issues are carefully reviewed on the basis of their scientific merits and ethical implications by both national and European experts. Their opinions are then passed on to a regulatory committee containing representatives of all 25 EU governments. To be approved for EU funding, a project must secure a majority vote in the committee. "It is the most rigorous framework around," explains one Commission official.

The MEPs' attempts to cut off Union finance have provoked a counter-attack in the EP led by Robert Goebbels, a Luxembourg Socialist member and former finance minister. He is writing to Barroso explaining the need for the EU to remain involved in this particular area of research and is canvassing wider support among his colleagues. In his letter, Goebbels acknowledges that eight EU countries have very restrictive legislation on embryonic stem cell research. But he reminds the Commission President that when the EP pronounced on the current research framework programme, there was "a clear majority" in support of financing research on embryonic and adult stem cells. He also stresses that the Union cannot exclude itself from an area which promises significant therapeutic breakthroughs. He points out that a Swiss referendum has authorised research on embryonic stem cells and that another in California has established the use of public funds in this area even though the American federal budget is more restrictive. There are no restrictions on American private research, while countries ranging from Israel to China and Japan are making progress on embryonic and adult stem cell research. He also points out that Germany bans such research, but allows it on imported stem cell lines.

While there is certain to be a keen debate within the EP on whether the possibility of EU funding for such research should be prohibited or not, EU governments have, up till now, taken a more pragmatic approach, allowing it, even if banned domestically.

Agreement on the new multiannual research framework programme is also dependent on the successful outcome of a separate debate on the scale of the EU's overall budget for the same period. If this wider financial issue is not settled by the end of the year, it is unlikely that the research programme will be able to begin in January 2007 as intended.

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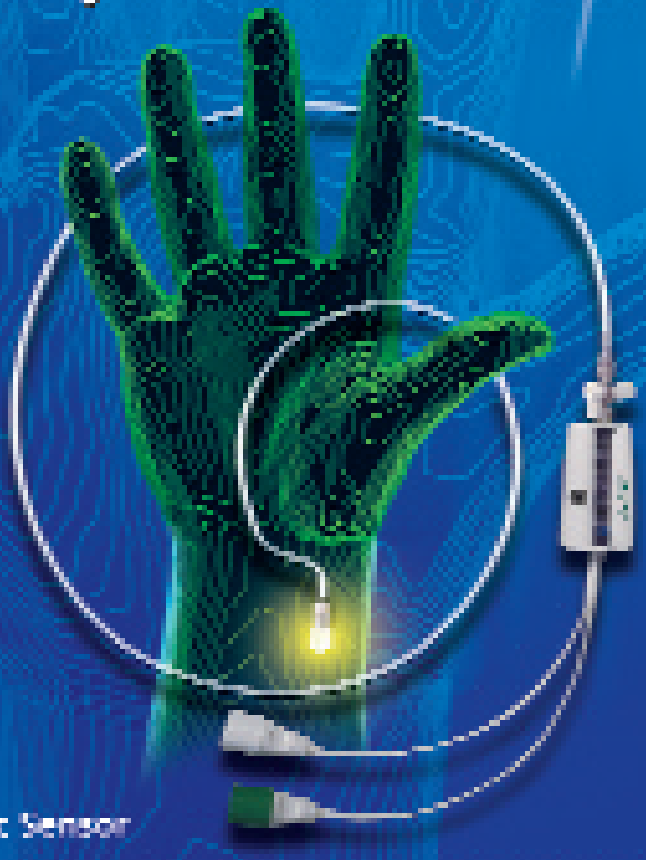

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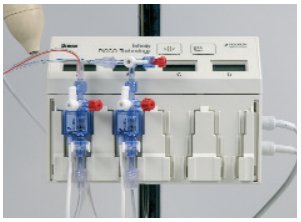
At MEDICA 2005 in Düsseldorf, Frost & Sullivan awarded Dräger Medical the 2005 Award for Technology Innovation in the multiparameter patient monitoring market, in recognition of the Infinity® Pick and Go® continuous monitoring technology. Through the use of a single, transportable patient monitor, the Pick and Go system eliminates the need for separate transport monitors and enables patient vital sign data to be continuously tracked during procedures, transport from remote locations, and throughout a facility. This technology directly addresses one of the Society of Critical Care Medicine's guidelines for the transfer of critically ill patients, which stipulates that technology-permitting, patients should receive the same physiologic monitoring during transport to that received in the ICU.

Siemens Communications and Dräger Medical are further increasing mobility of medical staff in hospitals with an integrated wireless IP infrastructure. This solution will make patient monitoring data available hospital-wide using existing hospital networks and the latest Wi-Fi WLAN technology. Doctors and nursing staff will have access to clinical applications and real time patient monitoring data at any time, from wherever they happen to be on duty in the hospital. Further integrated solutions will also be possible. For example, using Infinity Gateway technology, alarms triggered by a patient monitor could be automatically routed through the hospital network using the intelligence built into the nurse call system – delivering the message directly to the most appropriate caregiver who can provide the quickest response to the emergency.



Dräger medical & Pulsion medical systems

www.draeger-medical.com, www.pulsion.com

Also at MEDICA 2005, Dräger Medical and Pulsion Medical Systems unveiled the Infinity PiCCO SmartPod for Infinity patient monitoring. This solution integrates Pulsion's PiCCO-Technology for complete haemodynamic monitoring including preload volumetry, lung water measurement, contractility, and continuous cardiac output, with Dräger Medical's Infinity patient monitoring. The Infinity PiCCO SmartPod supports both adults and paediatric patients. Clinicians simply plug the PiCCO Pod into the Infinity patient monitor and have immediate access to a range of PiCCO-Technology parameters.

ESICM Awards

www.esicm.org

In September 2005, the European Society for Intensive Care Medicine (ESICM) held its 18th Annual Congress in Amsterdam, where outstanding research and contributions to the field of intensive care were recognized. The third Stoutenbeek Award was won by Professor Ken Hillman, Sydney, Australia, for the recently published MERIT trial conducted in 23 hospitals in Australia to evaluate effectiveness of the Medical Emergency Team (see Professor Hillman's articles on outreach in the summer and autumn issues of **ICU Management**). Professor Peter Suter, who retired from clinical practice in September and was the Society's first President, was awarded the ESICM medal for his unique contribution to intensive care at an international level. Dr A.M. Habib and colleagues in Belgium won the International Sepsis Forum abstract award. A further six ESICM abstract awards were received by researchers from China, France, Germany and the Netherlands, and also by the ETHICUS study group (see further below).

Joint research funding by ESICM and industry partners was announced: the Spacelabs Intelligent Monitoring Award, the *iMDsoft* Patient Safety Research Award, the Alain Harf Award on Applied Respiratory Physiology sponsored by Hamilton Medical, and the Eli Lilly – ESICM Sepsis Elite Award. The call for proposals for these research grants is open until 31st March 2006 and is restricted to ESICM members. For further information on membership and these grants, visit the ESICM website.

ETHICUS study: end of life decisions

www.esicm.org

Dr S. L. Cohen and his colleagues won an ESICM abstract award for the ETHICUS study, in which they collected data on end of life (EOL) decisions prospectively from 37 European ICUs in 17 countries. Data from 4248 patients were collected, out of which 95% had lacked decision making capacity at the time of EOL decision; patients' wishes were known in only 20% of the cases. Further analysis showed regional differences, with physicians in Northern countries having more discussions and more information about patients' wishes than Central countries, and those in Southern countries having the least. Families were told of the decision in 88% of the cases and only asked about the decision in 38% of the cases. Dr Cohen and colleagues conclude that the study demonstrates a need to improve communication within European ICUs (see also Dr Todd Dorman's second installment on communication skills for intensive care on page 32 in this issue of **ICU Management**). The ETHICUS study is sponsored by ESICM and the European Commission.

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From paper to **computer supported** decision making; how far are we?

Drs Decruyenaere and Colpaert review the impact of information technology on intensive care practice and the need for computer supported decision making.

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The intensive care unit (ICU) has several characteristics which make it favourable for extensive use of information technology (IT). Firstly, it has an overwhelming amount of data, often leading to data-overload and loss of information. Secondly, intensive care medicine has a short diagnostic-therapeutic cycle compared to other medical disciplines. IT can therefore play a pivotal role in supporting and supervising the process of medical decision making. Thirdly, intensive care medicine is extremely expensive and consumes a large portion of available healthcare resources. In the U.S., it is estimated that ICU medicine costs between 0.5% and 1% of the gross domestic product. An integrated computerization of the ICU could optimize use of resources, leading to substantial cost savings.

Current situation

The development of a dedicated ICU-IT-system is now so complex and time-consuming that on-site development is nearly impossible. Commercially available products are purchased and adapted to match as closely as possible the local needs of the ICU. Only a few bigger companies and maybe a dozen smaller companies currently offer dedicated software solutions for the ICU. None of the available software products are perfect and although they share many common features, they differ in smaller ways, resulting in product-specific advantages and disadvantages.
All of the software products share two main functions:

- recording and automatic storing of data from the different monitoring devices surrounding the patient, including the data from the monitor and the mechanical ventilator and automatic capture of syringe pump infusion rate, and
- the replacement of all handwritten forms by computerized equivalents such as the Computerized Physician Order Entry (CPOE), including the electronic prescribing of medication.

Most ICU-IT-systems offer some basic form of work flow management and some even have basic alerting properties, but advanced computer decision support is still lacking.

Potential benefits

EVALUATING BENEFITS - Benefits of IT-systems are hard to measure. From the management viewpoint, only direct financial benefits are important. Unfortunately, an immediate financial return of investment (ROI) is – at least now – hardly achievable. Non-financial benefits are however at least as important, such as improving the quality of care, decreasing the length of stay in the ICU and achieving a higher survival rate. In an indirect way and seen over a longer time span, this will also lead to minimized ICU costs.

TIME - Several studies have investigated the impact of IT in the ICU on nurse time. The older studies showed no time benefit, but a recent well-designed study showed that the introduction of an ICU-IT-system in a cardiosurgical unit reduced documentation time of the nurses by 29 minutes for every 8 hour shift (Bosman et al. 2003). This time was completely re-allocated to direct patient care.
In our ICU, nurses generally experience the new system as time-neutral. However, it is important to take into consideration that the computer-based ICU file is now much more complete and accurate. ICU physician workload is considerably higher, especially for physicians in training, but again, the amount and quality of the patient information is substantially more valuable.

> ... at least 7000 patients die in US hospitals annually as a result of medication errors

COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE) - In 1999, the Institute of Medicine declared in their report "To Err is Human - Building a safer Health System" that at least 7000 patients die in US hospitals annually as a result of medication errors. These errors frequently result from problems with the paper-based medical record. Increasing prescription complexity (see table 1) also means that the physician's memory is not always a reliable bridge between research advances and clinical practice. Not only do adverse drug events (ADE) cause patient harm, their costs are estimated to be at least $2,000 per ADE.
CPOE features (table 1) thus help to minimize human error, improve medication management, facilitate reporting and improve resource utilization. Even in its most basic form, a CPOE system can reduce the number of poorly written prescriptions, which can lead to the wrong drug, wrong dose or wrong route of administration.
Evidence for CPOE use generally is shown in table 2. Only a few studies have been published evaluating the impact of CPOE on medication errors in the ICU. A recent prospective study conducted in our adult SICU demonstrated an impressive decrease in medication prescription errors after

the implementation of an ICU-IT-system with CPOE (27% vs. 3.4%, p<0.001; Colpaert et al. 2004). This was mainly due to the almost complete elimination of true prescription errors and incorrect orders, which have no real potential to cause serious harm. However, there was also a six-fold decrease in the more important ADEs.

Decision support and computerized guidelines - Some ICU-IT-systems already have basic alerting possibilities, but sophisticated computer-based decision support is still a sort of "Holy Grail". The lack of computerized decision support is not only a technological problem but is also due to a lack of well-tested, effective and universally-accepted decision support models and rules for the ICU. Some groups, like Morris and colleagues from Salt Lake City, have already developed extensive and computer-based detailed treatment guidelines. These guide the clinician by using embedded decision rules and combining them with the actual physiological data of the patient to provide immediate bedside decision support.

ICU management and research - An ICU- database is an essential tool for benchmarking, for comparing ICU performance using standardized outcomes and for controlling ICU costs. An even greater potential lies in ICU research. Using large databases which combine data from different centres will undoubtedly lead to significant research advances, particularly in outcome research.

Future trends

Although current ICU-IT-systems succeed in providing a paperless ICU, many of the above mentioned benefits have yet to be realized. Many problems remain unsolved: a too rigid user-interface, the technological complexity of the systems, the poor integration of ICU-IT-systems with other hospital information systems and the high implementation and maintenance costs. All these factors help to explain the fact that after decades of development, only a minority (probably less than 5%) of ICU departments currently make use of one of the available systems. Another essential factor is that current ICU-IT-systems only provide very limited support for the interpretation of the massive amounts of data that far exceeds human decision making limits.

Indeed, current systems do not have advanced bedside clinical decision support or advanced support of the ICU workflow processes. However, it is universally believed that the next major progress in ICU-IT-systems will be the implementation of a whole range of (semi)-intelligent software programs, providing continuous assistance to the ICU team while caring for the critically ill patient. These software programs are often called "intelligent" agents, because they perform a clearly defined task, normally performed by a human. In the ICU, many smaller tasks are performed simultaneously. Medications are added and infusion pump rates are continuously adapted against specific monitoring parameters (e.g. insulin pump according to glycaemia levels). In some cases, a hierarchy of agents is needed. An example is the prescription of medication, where one subagent is responsible for the right dosing in the presence of renal failure, another in the presence of hepatic failure and a third one for checking interactions between the different prescribed drugs.

Other IT developments such as telemedicine, robotics, use of personal digital assistants (PDAs) and use of web-based ICU registries are also discussed further in this issue of **ICU Management**.

Table 1. Prescription error causes and CPOE support

Reasons for prescription errors	CPOEs support by:
• a continuously increasing number of available drugs • dosing regimen complexity • changing drug indications • numerous contra-indications • numerous adverse effects	• recognizing drug allergies • showing relevant laboratory results • automatically calculating the correct drug dose • recommending dosage adjustments in renal or hepatic failure • showing evidence-based guidelines

Table 2. Evidence for CPOE benefits

Application	Results
CPOE in general wards (Bates et al. 1999)	Non-intercepted serious medication errors were decreased by 86%
CPOE with a more sophisticated computerized decision support system for prescribing antibiotics (Evans et al. 1998)	Significant reduction of • reduction in duration of antibiotic therapy • the cost of antibiotics • total costs • length of hospital stay

Conclusion

Computers have been used for more than thirty years in the ICU and currently available programs automatically record all monitoring data and replace all paper forms by an electronic equivalent, resulting in a paperless ICU. However, widespread implementation is still lacking due to the high implementation costs, the complexity of hardware and software configuration, interfacing problems with other hospital departments, the lack of proven benefits, the fear that computers will replace physicians in decision making, and concerns about security.

It is our conviction that within the next few years, full ICU computerization including advanced real-time and bedside decision making capabilities will become essential to guarantee the highest quality of care for patients, to optimize nurse and physician work flow, to ensure economical ICU management, and last but not least, to support advanced research by using large multi-centre patient databases.

Robotic **Telepresence Rounding**

Dr Vespa writes on the benefits of Robotic Telepresence based on practical experience at UCLA Neurointensive Care Unit.

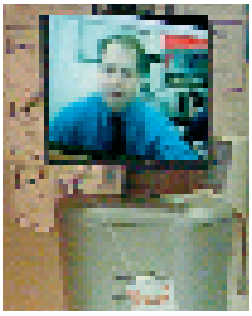

Figure 1. Robotic Telepresence © 2005 UCLA University of California

The problem

Providing timely and routine attending-level expertise is one of the main goals of critical care medicine (Haupt et al. 2003). But providing this expertise 24 hours-a-day is difficult given the shortage of intensive care specialists (Ewart et al. 2004).

The solution

The strategic use of telemedicine has the potential to enhance the supply of attending level expertise and improve patient care and safety as well as hospital profitability (Breslow et al. 2004; Rosenfeld et al. 2000).

In the UCLA Neurointensive Care Unit, we have chosen a telemedicine approach called Robotic Telepresence (Latifi et al. 2004; Vespa 2005). Robotic Telepresence (RT) is the concept that the physician is able to look and feel real to those in the intensive care unit and interact in a human way with the environment. This is accomplished through using a remotely-controlled robot which projects the image of the physician in real time on a flat screen mounted at the head of the robot (figure 1). The robot is mobile and under the control of the remotely located physician to move around the ICU in a manner which is similar to walking around the ICU on foot. The flat screen serves as the head and is able to move in 360 degrees and orient to directly face a person in the ICU. The RT method permits real time, two-way, face-to-face communication with the nursing staff, patients and families in the ICU. This interaction provides important visual information that cannot be easily conveyed by phone, such as the appearance of the patient, graphical data, waveforms, and body language.

How we use RT

We have used the RT for the past year at UCLA to make RT rounds by the attending physician from home. The attending makes two sets of RT rounds each day: daybreak RT rounds at 0600 hours with neurosurgical residents, and night time RT rounds after 2100 hours, in addition to normal "in-person" rounds in the ICU each morning. RT rounds consist of moving from bed to bed, reviewing the ICU flow sheet, discussing ongoing treatments with the residents (trainees) and bedside nurse, and culminate in generating a treatment plan.

Benefits of RT

We have preliminary observations suggesting that RT leads to improvement in the delivery of ICU care. We have noted:

- Improved education of our residents (trainees);
- Improved ICU bed-turnover due to more rapid triage decisions made via RT at night or during daybreak rounds;
- Decreased response time by the attending to make treatment decisions on critical patients;
- Increased compliance with ICU standard protocols due to night time RT;
- Improved nursing and family satisfaction from speaking with the attending via RT at night.

We have combined RT with an advanced data and image integration system, called Global Care Quest® (Los Angeles, CA). This enables review of crucial imaging and laboratory data simultaneously by the RT attending and other team members (i.e. nurses, trainees, consultants), thus providing a platform to make multidisciplinary rounds and decisions. For example, using the combination of RT and Global Care Quest®, the attending can remotely discuss the latest chest radiograph and arterial blood gas with the nurse and respiratory therapist, order a change in the mechanical ventilator and see the immediate result with all parties sharing the experience. Using this approach, we have successfully avoided complications that may otherwise have occurred.

Conclusion

In our hands, RT has been useful in enhancing trust and camaraderie among the multidisciplinary team and families of our patients. This results primarily from the nurses and families feeling that the attending is always there or at least nearby. While interaction with the robot is potentially awkward, we have been pleased that our nurses, patients and families interact with the robot as if it is a person. This interaction is critically important and occurs spontaneously with only a brief orientation. It is not completely clear why this occurs, but this may reflect the mobility of the system, direct facial contact and the sense of sharing. In a world in which impersonal telephone interactions are commonplace (i.e. "beep, you have reached a pre-recorded message"), RT is distinctly human. We see a real potential for RT to help the ICU team fulfil its mission of compassionate, timely, expert care of the critically ill patient.

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ICU **Telemedicine** in **India**; promises and reality

Dr Raja and colleagues explain the potential of telemedicine for critical care in India, the obstacles to its implementation and how these are currently being addressed.

Potential in India

Most ICUs in India face a shortage of trained intensivists. Additionally, many ICUs lack an effective ICU care delivery model, which is pervasively effective and continuously managed by experts. On the other hand, telemedicine departments are growing rapidly and an excellent synergy exists between the Indian Space Research Organization and private players in this field. This allows telemedicine to be applied to optimize ICU patient care in several ways, which we outline here.

Remote data access - Hospitals can use remote management to allow off site intensivists to provide expert input to on site physicians when needed. At present this happens by telephone. Inaccurate or insufficient information from the on site physician hampers efficiency of this model. Two way real time visual data transmission enables an on call intensivist to review the data and improve the quality and productivity of the system.

Pooling resources - Hospitals with insufficient intensivists could network with quality critical care departments tapping their resources and expertise. This E-ICU model opens up commercial possibilities, and wider penetration and utilization of available limited resources.

Broader cover - Rural hospitals without trained ICU staff can contract tertiary care centres to bridge their deficiencies. Quality medical expertise is unfortunately concentrated in urban India. Telemedicine can spread the expertise and also improve interhospital transfer of critically ill patients, and management of out of hospital critical events.

Efficient monitoring systems - Shortage of ICU manpower also applies to nursing staff. This coupled with the fact that most ICUs have a capacity of more than 10 beds, underscores the need for an alternative continuous monitoring system, which doesn't rely on high staffing levels. Telemedicine can alert intensivists of abnormal physiological parameters, process clinical data and activate clinical decisions.

Obstacles to implementation

Though these possibilities are encouraging, there are many potential hurdles to implementation, including varying regulations across states, lack of guidelines on legal and confidentiality issues, costs and the need for critical care training.

Non-standard regulations - A doctor registered with a state medical council can practice medicine in any part of India. However, some states demand a separate registration with their own medical council. Apparently no law mandates this and the decision primarily rests with the concerned bodies.

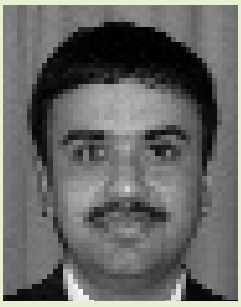
Lack of guidelines - Patient confidentiality and medicolegal implications of E-prescription are unclear, as presently no guidelines exist.

Costs - In the absence of comprehensive health insurance on a mass scale, the bulk of medical expenditure is borne by patients themselves. Any technological service adds to the "fee for service model" and may cause resistance from healthcare providers and consumer health forums.

Training - Any critical care process starts with assimilation of clinical data followed by interpretation, which leads to an action, which in turn results in a clinical outcome. Telemedicine ensures the first two components. The third part, action, requires on site manpower (assuming we are discounting the role of robotics, currently used in only two hospitals). Hence to widen the reach of ICU telemedicine, we need to train on site staff in basic ICU procedures and techniques.

Future directions

The critical care unit at our hospital functions as an E-ICU and offers services in setting up and maintaining ICUs. The high dependency unit admitting post angiography and angioplasty patients is covered by a telemedicine monitoring system. A study to analyze whether application of telemedicine expands the frontiers, improves patient care and de-escalation of costs is underway. We observe a positive trend towards formulation of a law governing medicolegal implications of E-prescription and care and some private firms are doing research in developing smart alarms tailored to local needs. The intensive care training programmes offered by the Indian Society of Critical Care Medicine and the National Board shows a very high enrolment rate. The result is likely to be a fundamental change in the way critical care medicine is practiced in India.



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Handheld computing

Handheld computing technology has the potential to become an important component of integrated information management systems for intensive care. These devices provide a portable platform for point-of-care clinical reference, patient management and communication.

Hardware options

Handheld computers are used by 30% to 60% of physicians in North America. They have the advantages of portability, relatively low cost and switch on immediately without the delay of a booting process (Adatia and Bedard 2002). However, potential disadvantages include the small screen size and unfamiliarity of many users with handwriting recognition systems or thumb keyboards (Lapinsky et al 2004). Currently the Palm and Microsoft Windows Mobile operating systems (OS) dominate the market. The Microsoft systems allow efficient file transfer with many Windows desktop programs but Palm OS devices are more commonly used by medical professionals, taking advantage of the variety of medical applications available (Adatia and Bedard 2003).

This handheld technology can be used as a stand-alone device or functioning as a client linked to a network. As a stand-alone system, data is stored on the device memory or a removable memory card. This simple and cheap solution is limited by the amount of memory available and the ability to update data. Using wireless connectivity (cellular, Bluetooth, WiFi), data on a central server can be accessed in real-time, offering the benefits of increased memory and computing power and access to up-to-date information. While concerns exist regarding electromagnetic interference with medical equipment, wireless devices can be implemented in the critical care environment with appropriate precautions (Shaw et al. 2004).

Roles for handheld computers

The handheld device can act as a mobile point-of-care interface to access patient information and enter orders, as a component of an electronic clinical information system. Electronic prescribing can reduce costs and errors and improve quality of care by providing dosing and drug interaction checks. The prescription can be transmitted directly to the pharmacy using wireless systems. However, the size of the screen allows only a limited portion of the clinical record to be viewed and order entry carries the risk of typographical errors. Data security and patient confidentiality need to be addressed, and systems utilizing the handheld as a browser to access a central data repository have the advantage that no confidential data is stored on the device.

As an independent function or a component of a clinical information system, the handheld computer enables access to management guidelines and protocols at the point-of-care. The small screen is not optimal for viewing long text documents and applications should take full advantage of searching and hyperlinking functions (Lapinsky et al. 2004).

The scheduling and address book functions of handheld devices remain the most commonly used and valuable applications (Fischer et al. 2003). Time and cost benefits can be achieved through the integration of the physician's handheld device with a personal or institutional scheduling application.

Computerized billing applications using handheld devices are increasingly used and have demonstrated financial benefits. Mobile computing devices can also be used to improve communication in hospitals, combining pager, cellphone, email and messaging in a single device.

Barriers to handheld devices

Although use is increasing amongst physicians, handheld computers have not reached the level of acceptance of conventional computers. The major limitations are the small screen size and memory capacity, and unfamiliarity. Images can be displayed, but are not adequate for medical diagnostic purposes. The Palm OS does not support multi-tasking, allowing only one application to be opened at a time. While many users become proficient in the handwriting recognition systems, they continue to generate errors. The small thumb keyboards are effective, but typing speed is limited.

In addition to the physical and functional barriers of mobile computers, a culture of resistance remains to changing physician practice. In many cases this may be directly related to the functional limitations or to previous experience with a new and error-prone system. If a desktop computer is immediately available, this is often a preferable interface. The physician is often not the recipient of the benefits and may feel that a handheld system involves more work or complexity.

Conclusion

Information technology is essential to enhance the efficacy and reliability of intensive care. Handheld computing technology offers a potentially important component of future integrated information management systems.

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NICE online for **benchmarking**

Dr Benner and colleagues describe the online version of the Dutch National IC Evaluation (NICE) registry, which allows real time data analysis and retrieval for benchmarking.

Table 1. Wizard steps for customising data analysis

1. Select the *functions* to be presented, such as mean length of stay or standardized mortality rate based on APACHE II.
2. Select split-elements, or groups. The selected functions will be presented for separate groups, e.g. for survivors and non-survivors.
3. Select the *benchmark reference*, e.g. the national average or the average of (non)university hospitals.
4. Restrict the population of interest, e.g. to patients admitted during a certain time period or to patients older than 80 years.

In 1996 the National Intensive Care Evaluation (NICE) registry was established to gain insight into and improve the quality of Dutch intensive care units (ICUs). Insight into the quality of ICUs is acquired through benchmarking. Benchmarking is the process of comparing performance measures, such as case-mix adjusted mortality and length of stay, of an individual ICU to a reference, generally the national average. Currently 32 Dutch ICUs participate in the NICE registry, which contains 112 data items for each patient admitted to participating ICUs. To support the individual ICUs in the analysis of their performance, the NICE foundation has introduced an Internet-based application, NICE Online. The NICE Online application supports the benchmarking process of the participating ICUs by presenting and comparing their own patient population and performance to several standards, in real time.

NICE Online allows users to request their own customized data analyses through a four-step wizard (see table 1). An example request is shown in figure 1, with the four steps to analyse data and present a graph showing the mean length of ICU stay (function) for survivors and non-survivors (split element). The analysis compares the user's own ICU with all Dutch hospitals (benchmark reference). Readmissions to the ICU are excluded through the population restrictions. The result of the requested analysis is presented in a graph shown to the right of figure 1. In this fictitious example the columns represent the mean ICU length of stay (LOS) for survivors and non-survivors of the user's own hospital (columns 1 & 3) and all participating ICU's together (columns 2 & 4). The results of a data analysis, presented in either a graph or a table, can easily be transferred to other files, for example for management reporting purposes.

Benchmarking should be an internal quality improvement method without external (financial) consequences (Lilford et al. 2004). Within the NICE project, protecting the privacy of individual ICUs is therefore extremely important. To protect the privacy of patients and also of ICUs, a user login and password is necessary for access, data for transfer is encrypted using the Secure Socket Layer (SSL), a copy of the original NICE database without patient- or ICU-identifiable information is used instead of the centrally stored data with identifying data, and the database that can be requested is stored between two firewalls. Furthermore, some combinations of functions and comparisons are disabled, if they threaten privacy by making data identifiable.

The NICE foundation has developed an application that enables the participants of the NICE registry to perform their own analyses online. NICE Online offers its users a high degree of freedom, while the privacy at patient and hospital level is guaranteed. Through NICE Online, individual ICUs can analyze their relative performance, providing insight into quality of care, which is a prerequisite to quality improvement.

Figure 1. Query to NICE online and (fictitious) result

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Keyboard and mouse acting as reservoirs for pathogens

Keyboards in ICUs may serve as reservoirs for microorganisms, which may be transferred via the hands of personnel to patients causing nosocomial infections.

Reviewing the evidence

It is estimated that at least 2 million patients in the US acquire nosocomial infections annually. The prevalence of nosocomial infections ranges between 3.5% of all treated infections in hospital (Garner et al. 1988) to more than 30% of the treated infections in ICU (Spencer 1996; Vincent et al. 1995). In one out of three cases, nosocomial infections are caused by exogenous modes of infection. Their most common mode of transmission is the hands of medical staff (Pittet et al. 1999). Manual cross-transmission of microorganisms via computer components at the patients' bedside might introduce an additional risk for critically ill patients, considering the frequent contact of medical staff with these fomites. ICU bedside computers may play a role in the transmission of nosocomial pathogens, as shown by recent studies and reviews (Hartmann et al. 2004; Neely et al. 1999; Neely and Sittig 2002). The same has recently been reported for computer interfaces (Bures et al. 2000; Neely et al. 1999; Neely and Sittig 2002), potentially causing nosocomial infections, an important cause of hospital morbidity and mortality resulting in increased medical costs (Jarvis 1996).

> Proper hand disinfection is still the mainstay of any preventive measure for reducing infections

Neely et al. (1999) reported that Acinetobacter baumannii has been found more often on computer keyboard covers than on any other object in patient rooms. This coincided with an increase in patient colonizations, suggesting a link between contaminated computer keyboards and patients.

Bures et al. (2000) cultured a number of microorganisms, including methicillin-resistant Staphylococcus aureus (MRSA), Enterococcus spp., and Enterobacter spp., from keyboards. However, the twofold increased contamination rate for keyboards (24%) in comparison to faucet handles (11%) was not statistically significant. Furthermore, they detected similar rates of computer hardware contamination regardless of location in the ward. However, a direct connection between infected patients and keyboards was shown for MRSA using pulse-field gel electrophoresis, a particularly sensitive molecular genetic technique for distinguishing isolates of the same genus and species.

Devine et al. (2001) cultured MRSA from computer keyboards in two hospitals. Incidences were consistent with the significantly higher rate of MRSA transmission (24%) found at one of the hospitals.

In our own study (Hartmann et al. 2004), we found greater colonisations of microorganisms on keyboards and mice (6%) than for other user interfaces, e.g. infusion pumps and telephone handsets (3%). The sampled microorganisms contained a small quantity of Entercoccus sp. and S. aureus, located mostly in patient rooms. S. epidermidis was also sampled in patients' rooms, especially on computer interfaces.

Reviewing the solutions

More frequent contact with keyboards than with perfusors and ventilators may explain the higher contamination rate of keyboards and mice, possibly causing cross-transmission of pathogenic organisms. Direct contact of nurses and physicians with both the patient and the bedside computer terminal puts the patient at higher risk. Thus, updating computer infection control procedures would seem justifiable. Plastic keyboard and mouse covers with regular cleaning policies lead to a reduction of contamination (Neely et al. 1999). However, the benefit of such measures in reducing nosocomial infections has not yet been clearly demonstrated (Dharan et al. 1999). Hence, the additional costs incurred by these measures do not yet seem justified.

Also, plastic keyboard covers do not provide secure protection against bacterial transmission, considering that frequent use leads to a quick recontamination of these surfaces. Without hand washing or gloving, staff may, even without direct patient contact, lead to a transmission of pathogens (Neely and Maley 2001). Hence, it is recommended that the same infection prophylaxis used for direct patient contact should be applied when dealing with computer hardware.

Although Dharan et al. (1999) report a reduction of the colonisation rate of microorganisms through enforcement of a surface disinfection policy, this did not reduce the rate of nosocomial infections. Hence, proper hand disinfection is still the mainstay of any preventive measure for reducing infections (Hugonnet and Pittet 2000a&b) and should be extended to fomites within the patient's proximity and other locations in the ward, including computer keyboards and mice in the ICU setting.

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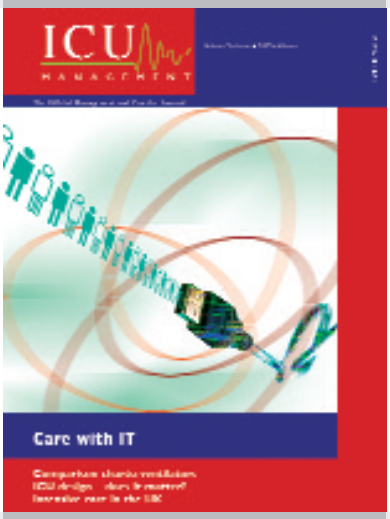

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Timing of initiation of Renal Replacement Therapy in Acute Renal Failure

Drs Kellum and Venkataraman review the evidence on timing of initiation of renal replacement therapy in Acute Renal Failure.

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Acute renal failure (ARF) occurs in as many as 15% of critically ill patients and is associated with significant morbidity and mortality. Despite the common occurrence and high morbidity and mortality associated with ARF, no pharmacological interventions have been shown to be efficacious for treatment. Supportive care, including renal replacement therapy (RRT) remains the mainstay of management for critically ill patients with ARF. Although RRT is widely prescribed for ARF, controversy exists on the best time to initiate RRT in these patients.

There is currently no consensus on the indications for RRT in ARF. Like other aspects of RRT, the indications have generally been extrapolated from the end-stage renal disease (ESRD) experience. These indications have generally included refractory hyperkalemia, fluid overload not responding to diuretic therapy, severe persistent metabolic acidosis and overt uremic symptoms (pericardial effusion, encephalopathy etc). While there is little dispute regarding the necessity of RRT for the above indications, there is neither consensus on the degree of azotemia nor on the duration of ARF warranting initiation of therapy in the absence of these "absolute" indications. Patients with ARF are generally sicker, and warrant tighter acid-base, electrolyte and fluid balance control compared to ESRD patients. Moreover, critically ill patients with ARF are also more catabolic and need increased nutritional protein and hence generally have higher urea generation rates than ESRD patients. Finally, volume intake in these patients cannot be limited, due to the obligate administration of intravenous medications such as antibiotics and continuous infusions of vasopressors. Hence, intuitively, many would argue that, waiting for "conventional" indications for initiation of RRT in patients with ARF may be inappropriate and that the earlier RRT is provided, the better the outcome will be. However, evidence in support of this notion in ARF is lacking. On the other hand, many patients with ARF recover renal function without requiring any RRT. Excessively early initiation therefore poses the risk of initiating therapy in patients who might never require RRT using a more conservative approach (Venkataraman et al. 2005). Finally, the modulation of inflammatory mediators, particularly in patients in whom ARF occurs in the setting of sepsis or multi-system organ failure, has been proposed as an additional indication for RRT. However, controversy exists as to whether conventional doses of dialysis can effectively clear inflammatory mediators and hence this indication currently remains limited to experimental protocols.

Only two clinical studies have tried to evaluate the effect of timing of initiation of RRT on clinical outcomes in ARF patients and have provided conflicting results. One retrospective study, which used serum BUN as a surrogate for "timing of initiation" of RRT in ARF, showed that patients who were dialyzed earlier in their course of disease (mean BUN 42.6 mg/dl) had a better survival (39% vs. 20%) compared to those for whom RRT was initiated later (mean BUN 94.5 mg/dl) (Gettings et al. 1999). Although this study is limited in that it is retrospective and that the reasons for initiation of RRT in the two groups were likely to have been different, these data suggest that initiation of RRT earlier in the course of ARF may be of benefit.

However, a subsequent prospective randomized study by Bouman et al. (n =106) (2002), does not support this finding. In this study, patients were randomized to three groups: early high-volume haemofiltration (n= 35; 72-96 L per 24 hrs), early low-volume haemofiltration (n=35; 24-36 L per 24 hrs), and late low-volume haemofiltration (n=36; 24-36 L per 24 hrs). In this study, survival at 28 days and recovery of renal function were not improved using early initiation of haemofiltration. This study is limited in that it was clearly underpowered to detect any differences in outcome.

In summary, no definitive conclusions can be made with regards to whether early initiation of RRT improves outcome in patients with ARF. Larger RCTs are necessary to answer this question. Moreover, conventional markers used to define "early vs. late" initiation of RRT, such as BUN or creatinine, are extremely non-specific in the ICU setting. Hence consensus should be reached on the indications for RRT and what constitutes "early vs. late" initiation of RRT, prior to conducting larger trials.

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Preventive strategies for **nosocomial pulmonary infections** in mechanically ventilated patients

The appropriate use of prevention strategies for ventilator-associated pneumonia can reduce morbidity and mortality and costs associated with this nosocomial infection.

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Ventilator-associated pneumonia (VAP) is the specific type of nosocomial pneumonia (NP) that occurs after the first 48 hours of initiating mechanical ventilation (American Thoracic Society 1996). NP still remains a leading cause of death from hospital-acquired infections. Crude mortality rates range from 24% to 76% depending on the population and clinical setting studied (Fagon et al. 1989; Kollef 1993; Torres et al. 1990).

A variety of measures has been suggested for prevention of NP depending on the setting and the individual risk profile; non-antibiotic strategies are the main topic of this review (see table 1). These strategies have recently been reviewed by European, Canadian and American organizations and are outlined below (Dodek et al. 2004; Tablan et al. 2004; Torres & Carlet 2001).

Conventional infection control measures

HAND WASHING, PROTECTIVE GOWNS AND GLOVES - Cross-contamination via the inoculation of bacteria into upper and lower airways is an exogenous mechanism in the aetiopathogenesis of NP especially in the ICU. Hand washing is an important yet underused measure to prevent nosocomial infections. As with hand washing, the use of protective gowns and gloves during patient contact has also been found to reduce the rate of acquired nosocomial infections (Pittet, Dharan, & Perneger 1998), but their use appears to be most effective when directed at specific antibiotic-resistant pathogens.

CHLORHEXIDINE ORAL RINSE - Bacteria accumulated in dental plaque have been implicated as pathogens of VAP when aspirated to lower airways. Chlorhexidine is an antiseptic solution for the control of dental plaque that seems therefore reasonable to use in selected high-risk patients, given the easy administration and the reasonable costs (Fourrier et al. 2005).

Table 1. Preventive strategies for VAP

Conventional infection control measures
• hand washing and use of protective gowns and gloves
• Chlorhexidine oral rinse
Strategies related to gastrointestinal tract:
• stress-ulcer prophylaxis
• nutritional support, gastric overdistension, nasogastric tubes
Strategies related to patient placement
• semirecumbent position
• rotational-bed therapy
Strategies related to the artificial airway
• respiratory airway care
• design of endotracheal tubes, continuous subglottic aspiration
Strategies related to mechanical ventilation
• maintenance of ventilator equipment, heat and moisture exchangers
• adjustment of sedation
• non-invasive mechanical ventilation

Strategies related to gastrointestinal tract

STRESS-ULCER PROPHYLAXIS - When gastric pH increases, the stomach can become a reservoir of nosocomial pathogens with the potential to colonise the upper respiratory tract. Mechanically ventilated patients are at risk of stress ulcers with gastrointestinal haemorrhage for which preventive treatment with H_2-blockers, antacids or sucralfate is routinely employed. However, H_2-blockers raise the intragastric pH. Use of sucralfate instead of H_2-blockers provides less efficient anti-ulcer prophylaxis, so that the risks have to be balanced for cost-effective treatment.

NUTRITIONAL SUPPORT, GASTRIC OVERDISTENSION AND NASOGASTRIC TUBES - Malnutrition has been shown to be a major contributing factor to the development of pneumonia by impairing host defence. Providing adequate nutritional support to intensive care patients is therefore important for the prevention of NP. As a general recommendation, early enteral nutrition should be provided to patients in intensive care, initially supplemented by parenteral nutrition when enteral nutrition can only be tolerated in low volumes.

However, it has been suggested that placement of a nasogastric tube in the stomach may facilitate the reflux of bacteria from the gut, introducing a risk factor for VAP. Gastric overdistension may facilitate the reflux of bacteria from the gut and should be avoided by reduction in the use of narcotics and anticholinergic agents, monitoring gastric residual volumes after

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intragastric feeding, use of gastric prokinetic agents (e.g. metoclopramide), and if necessary, supplying enteral feeding via nasojejunal intubation.

Strategies related to patient placement

Semirecumbent body position of patients - In supine position aspiration of upper-airway secretions is common even in healthy adults. It has been documented in a randomised clinical trial that a persistent semirecumbent body position reduced the incidence of NP in intubated and mechanically ventilated patients, but without a significant decrease in morbidity or mortality (Drakulovic et al. 1999). If there is no contraindication to the manoeuvre, for patients receiving mechanical ventilation with an enteral tube in place, the head of the bed should be elevated at an angle of 30-45 degrees.

Postural changes by rotating beds - Kinetic therapy through rotating beds, which change the patient's position, may also prevent VAP by enhancing pulmonary drainage. Automated position changing during the first five days in the ICU reduces the incidence of early NP, (but does not significantly reduce the number of days of mechanical ventilation, length of ICU stay or hospital stay, or in-hospital mortality). Rotating beds are much more expensive than standard ICU beds however, which limits the use of these systems.

Strategies related to the artificial airway

Respiratory airway care - Not only gross but also micro-aspiration of the lower airway can facilitate the development of NP despite the presence of an artificial airway. It is therefore important to maintain an adequate tube cuff pressure to reduce micro-aspiration.
Two types of suction-catheter systems are available: the open, single-use system and the closed, multiple use system; the risk of VAP appears to be similar with both systems.
Prolonged nasal intubation (> 48 hours) should be avoided because nosocomial sinusitis may predispose the patient to pneumonia through the aspiration of infected secretions from the nasal sinuses (Rouby et al. 1994). In cases where nasal intubation cannot be avoided (e.g. maxillar surgery), early tracheostomy may still be a cost-effective measure to prevent NP.

Design of endotracheal tubes - Stagnant oropharyngeal secretions pooled above the cuff can easily gain access to lower airways when the pressure of the cuff decreases spontaneously, or if there is a temporary deflation of the cuff which provides a direct route for tracheal colonisation and bolus aspiration from the oropharynx. Endotracheal tubes with an extra lumen designed to continuously suction secretions pooled above endotracheal tube cuffs are available and have been found to decrease the incidence of early VAP (Valles et al. 1995).

Strategies related to mechanical ventilation

Maintenance of ventilator equipment. Heat and moisture exchangers - Although transmission of bacteria via the respiratory equipment was identified as a cause of pulmonary infections more than 15 years ago, current systems are rarely a major source of bacteria. The frequency of ventilator circuit change has not been shown to be beneficial (Dreyfuss et al. 1991). Heat and moisture exchangers reduce the incidence of VAP by minimising the development of condensate within ventilator circuits (Kirton et al. 1997), are well tolerated by most patients and are easy to use.

Adjustment of sedation - Aspiration is an important aetiopathological factor of NP in patients with coma and an altered level of consciousness. Accordingly, sedative agents (and thereby level of sedation and the duration of sedation) in patients with mechanical ventilation should be adjusted for the individual patient. A strategy based on daily interruption of sedative-drug infusions until the patients were awake decreased the duration of mechanical ventilation and the length of stay in the intensive care unit (Kress et al. 2000). The use of excessive sedation could be reduced in this way.

Non-invasive mechanical ventilation - Several recent investigations have attempted to directly examine the influence of eliminating tracheal intubation on the incidence of NP. These studies suggest that prevention strategies should include efforts to eliminate or at least reduce the frequency of tracheal intubation (Antonelli et al. 1998).

Conclusion

The appropriate use of these techniques can reduce the incidence of VAP in ICU patients. Simple and effective methods without extra cost, such as hand washing or placing the patients in semirecumbent position should be part of routine practice. The use of more invasive and expensive preventive measures should only be used in patients who are at high risk of NP. The results of ongoing research may strengthen our preventive capabilities and help further limit the number of patients who currently develop VAP.

Perspectives of **mechanical ventilation**

Professor Ranieri and Dr Grasso review recent improvements in mechanical ventilation.

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The scientific interest for mechanical ventilation is demonstrated by a PubMed search made in October 2005: since 1950, more than 44,300 articles have been published on this topic. Intensivists presently have to face the challenge of translating this tremendous volume of knowledge into real clinical advantages for patients.

Some fundamental steps have already been made in this field, principally thanks to the translational research (Zerhouni 2005). Since the mid 1980s, a large number of studies in animal models of acute respiratory distress syndrome (ARDS) have shown that mechanical ventilation can worsen pre-existing lung injury (ventilator induced lung injury – VILI) (Matthay & Zimmerman 2005), by inducing closing and opening of collapsed alveolar units (atelectrauma), and/or alveolar overdistension at each respiratory cycle. Thanks to this knowledge, the effects of "lung protective" ventilatory strategies on VILI have been tested in clinical studies (Ranieri et al. 1999). Applied in a randomized controlled trial conducted by the ARDS Network, these strategies proved to reduce mortality of ARDS patients (ARDS Network 2000). The study by the ARDS network closed the loop between the laboratory and clinical approaches, perhaps for the first time in the field of intensive care medicine.

The last generation of mechanical ventilators presents interesting improvements in the field of partial ventilatory assistance modes (Ranieri 1997). Partial ventilatory support techniques are intended for patients who have normal respiratory drive, but who have difficulty sustaining adequate spontaneous ventilation. Clinical optimization of the patient-ventilator interactions requires a continuous matching between the triggering, flow delivering, and cycling functions of the ventilator and patient's ventilatory drive, spontaneous inspiratory flow demand, and neural inspiratory time. The logical development of ventilator technology has been to develop systems able to automatically interface physiologic parameters to ventilator outputs. Together with the older volume support mode, which is a peculiar form of pressure support ventilation (PSV) in which the applied pressure level is automatically targeted to a pre-set tidal volume, various forms of proportional assist ventilation (PAV) are now clinically available.

PAV is an innovative mode of partial ventilatory support in which the ventilator generates pressure in proportion to patient's effort (Younes et al. 1992). According to preliminary studies, PAV is able to near normalize patient's neuro-ventilatory coupling, making the ventilator an extension of patient's respiratory muscles and leaving the patient entirely in control of all aspects of breathing (Grasso et al. 2000). With the definitive technical implementation, PAV ventilators are able to measure continuously and non invasively the elastic and resistive properties of the respiratory system, and to continuously adapt the level of proportional assistance to the intrinsic changes in respiratory mechanics over time (Younes et al. 2001a & b).

Among the other computer driven automatic or semi-automatic algorithms recently implemented in mechanical ventilators are adaptive support ventilation (ASV) and the Knowledge Based System (KBS). ASV is a system able to deliver ventilatory assistance to obtain the "optimal" ventilatory pattern, i.e. the more favourable ventilatory pattern in terms of work of breathing (Belliato et al. 2004). KBS is an algorithm able to gradually withdraw the mechanical support and thus automatically wean the patient from mechanical ventilation. According to preliminary results, KBS reduces the "weaning time" as compared with physician-driven weaning protocols (Bouadma et al. 2005).

Another field of development for mechanical ventilators regards the devices for monitoring respiratory mechanics. Practically, all the modern intensive care mechanical ventilators are able to perform measurements of static elastance, resistance and intrinsic PEEP in ventilated patients. However, the mechanical characteristics of the respiratory system are often non-linear, and a very interesting possibility now available to clinicians is to measure quasi static volume-pressure curves of the respiratory system. The lower and upper inflection points can be identified on these curves through internal devices of the mechanical ventilator (Lu et al. 1999). In addition the possibility to measure residual functional capacity will potentially improve our understanding of the effects of positive end expiratory pressure.

In conclusion, in the last years the interplay between industrial interests and the clinician's requests has generated a synergistic effort towards the development of the new generation of intensive care mechanical ventilators. In the next years we should be able to assess all these innovations in a correct, evidence-based, perspective.

Ventilators for critical care

ECRI is a totally independent non profit research agency designated as a Collaborating Centre of the World Health Organization (WHO). Such organizations are appointed to contribute to WHO's public health mission by providing specialized knowledge, expertise, and support in the health field to the WHO and its member nations. ECRI is widely recognized as one of the world's leading independent organizations committed to advancing the quality of healthcare with over 240 employees globally.

ECRI's focus is medical device technology, healthcare risk and quality management, and health technology assessment. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organizations, ministries of health, government and planning agencies, voluntary sector organizations and accrediting agencies worldwide. Its databases (over 30), publications, information services and technical assistance services set the standard for the healthcare community.

Amongst its many products and services ECRI is pleased to provide readers of **ICU Management** with sample information on positive pressure ventilators designed for use in critical care from its Healthcare Product Comparison System (HPCS), which contains over 280 reports. The HPCS reports contain extensive information about the technology, its purpose, its principles of operation, stage of development and reported problems. This extract from our database contains model by model specifications for easy assessment and review. The ventilators for critical care comparison charts include ECRI's 'Recommended specifications' (generic templates) which can be used for comparison and tendering purposes.

All of ECRI's products and services are available through the European Office, addressing the special requirements of Europe and the UK. Utilising some of the world's largest health related databases, help, support and guidance can be given to our European clients at a local level. The comparative tables overleaf are extracted from ECRI's 2002 database and have additionally been reviewed and updated by the respective manufacturers. Publication of all submitted data is not possible: for further information please contact ECRI or editorial@icu-management.org.

Abbreviations & footnotes used in pages 26 - 29

ETS: *Expiratory trigger sensivity* - **TRC**: *Tube resistance compensation* - **HCP/O** = *High continuous pressure/occlusion*

ECRI RECOMMENDATIONS [1] *These recommendations are the opinions of ECRI's technology experts. ECRI assumes no liability for decisions made based on this data.* **GE HEALTHCARE** [G1] *(settable via rate and I:E ratio* [G2] *Pneumatic, synchronized and compensated* [G3] *for both inspiratory pressure and pressure support* [G4] *BiLevel VG not currently available in the US and Canada, BiLevel* [G5] *PEEPi, 12 day data, vent settings and alarm settings trends, alarm and event log* [G6] *Aeroneb Pro Nebulizer System built-in.* [G7] *for both pressure, flow and pressure support* [G8] *guaranteed, BiLevel* [G9] *EtO_2, $EtCO_2$, Vent soft limit indicators.* **MAQUET** [M1] *(Inspiratory rise time and inspiratory cycle off can be set)* [M2] *(Pressure regulated volume control), VS (volume support), BiVent, non invasive ventilation for all patient categories, SIMV (PRVC)* [M3] *And overlay loops, event log and service log, pause airway pressure, end expiratory flow, end expiratory pressure, spontaneous respiratory rate; continuous P01 measurement, WOB patient, WOB ventilator, SBI (Shallow Breathing Index), leakage fraction in NIV* [M4] *(Pressure regulated volume control), VS (volume support), BiVent, non invasive ventilation, SIMV (PRVC)* [M5] *(Pressure regulated volume control), VS (volume support), BiVent, non invasive ventilation (nasal CPAP, pressure support and pressure control), SIMV (PRVC)* [M6] *and overlay loops, event log and service log, recording possibility, continuous PO1 measurement, WOB patient, WOB ventilator, SBI (shallow breathing index), pause airway pressure, end expiratory flow, end expiratory pressure, spontaneous respiratory rate, leakage fraction in NIV* [M7] *Expiratory pressure, spontaneous respiratory rate, leakage fraction in NIV.* **DRÄGER** [D1] *Also APRV, MMV, AutoFlow, and PCV+, and automatictube compensation for all patient ranges, including nCPAP. All modes have the option of noninvasive delivery.* [D2] *PPS. Also APRV, MMV, AutoFlow, and PCV+, and automatictube compensation for all patient ranges, including nCPAP. All modes have the option of noninvasive delivery.* [D3] *PPS Smartcare™. Also APRV, MMV, AutoFlow, and PCV+, and automatictube compensation for all patient ranges, including nCPAP. All modes have the option of noninvasive delivery.* [D4] *Also new sensor, no calibration data, remote fault, and transducer fault.* **HAMILTON** [H1] APRV, NIV APV, (A/C and SIMV). **VIASYS** [V1] *Vsync, heliox* [V2] *& time sync, w/volume limit, loops/trends, MIP/NIF, Vsync, non-invasive*

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Future issues of ICU Management will also address the US market.

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Healthcare Product Comparison System

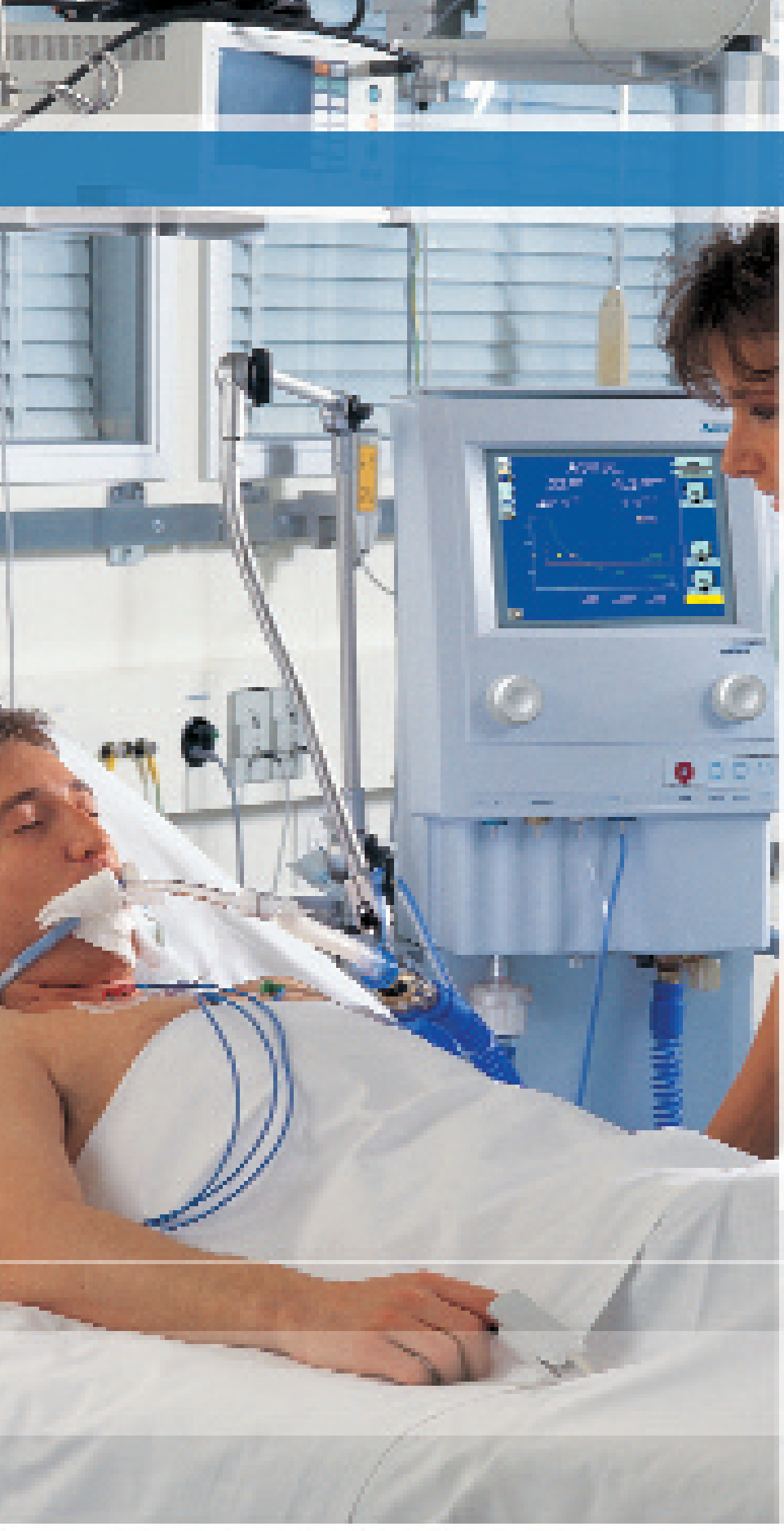
	ECRI RECOMMENDED SPECIFICATIONS[1]	GE Healthcare	GE Healthcare	GE Healthcare
MODEL	**BASIC IC VENTILATOR**	**CENTIVA/5 6.5" SCREEN**	**CENTIVA/5 12" SCREEN**	**ENGSTRÖM CARESTATION**
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
CONTROLS				
Tidal volume, mL	50-2,000	20-2,000	20-2,000	20-2,000
Insp flow, L/min	3-180	2-99.9 (max. peak flow 180)	2-99.9 (max. peak flow 180)	2-160 (max. peak flow 200)
Insp press, cm H_2O	0-80	1-59	1-59	1-98
Respiratory rate, breaths/min	6-120	4-100	4-100	3-120 (Control), 1-60 (Support)
Insp time, sec	0-3 pause	0.06-13.6[G1]	0.06-13.6[G1]	0.25-15
Exp time, sec	1-8	0.2-13.6[G1]	0.2-13.6[G1]	0.25-59.75
I:E ratio	1:4 to 4:1	1:9 to 4:1 (9:1 in BiLevel)	1:9 to 4:1 (9:1 in BiLevel)	1:9 to 4:1 (9:1 in BiLevel)
Insp hold/plateau	0-3 sec	Yes	Yes	Yes
Expiratory hold	0-3 sec	No	No	Yes
FiO_2, %	30-90	21-100	21-100	21-100
Manual breath	Yes	No	No	Yes
PEEP/CPAP, cm H_2O	0-45	Off, 2-35	Off, 2-35	Off, 1-50
Pressure support, cm H_2O	0-45	0-59	0-59	0-60
Nebulizer	Optional	Yes[G2]	Yes[G2]	Yes[G6]
Trigger mechanism	Flow, pressure, both	Flow	Flow	Flow and pressure
Bias/base flow range, L/min	1-20	3-30	3-30	2-10
Pressure slope/ramp adj.	Yes/yes	Rise time adjustment[G3]	Rise time adjustment[G3]	Rise time adjustment[G7]
ETS				
Sigh	Optional	No	No	No
100% O_2		Yes (suction maneuver)	Yes (suction maneuver)	Yes
TRC				
OPERATING MODES				
Assist/control				
. Volume breaths	Yes	Yes	Yes	Yes
. Pressure breaths	Yes	Yes (BiLevel)	Yes (BiLevel)	Yes
SIMV				
. Volume breaths	Yes	Yes	Yes	Yes
. Pressure breaths	Optional	Yes (BiLevel)	Yes (BiLevel)	Yes
. Pressure support	Yes	Yes	Yes	Yes
Spontaneous/CPAP				
. Pressure support	Yes	Yes	Yes	Yes
Apnea-backup vent	Yes	Yes	Yes	Yes
Others	User preference	Bi-Level	BiLevel with volume guarantee[G4]	Pressure control w/volume[G8]
EQUIPMENT ALARMS				
Gas supply failure	Yes	Yes	Yes	Yes
Power failure	Yes	Yes	Yes	Yes
Vent inoperative	Yes	Yes	Yes	Yes
Low battery	Yes	Yes	Yes	Yes
Self-diagnostics	Valve leak, sensor failure	Yes	Yes	Yes
Others	By user requirements	Flow sensor, circuit leak, patient detected in standby, patient disconnect	Flow sensor, circuit leak, patient connect, patient disconnect	Flow sensor, circuit leak, patient connect, patient disconnect, occlusion
PATIENT ALARMS O_2	Yes	Yes	Yes	Yes
Low minute volume	Yes	Yes	Yes	Yes
Low inspir pressure	Yes	Yes	Yes	Yes
High pressure	Yes	Yes	Yes	Yes
Loss of PEEP	Optional	Yes (indirectly)	Yes (indirectly)	Yes
Apnea	Yes	Yes	Yes	Yes
HCP/O	Yes	Yes	Yes	Yes
Inverse I:E	Yes	Visual warning	Visual warning	Ventilation limit indicator
High respir rate	Yes	Yes	Yes	Yes
High minute vol	Optional	Yes	Yes	Yes
High PEEP	Optional	No	No	Yes
Others		Low resp rate	Low resp rate	High/low tidal volume, low resp rate, high intrinsic PEEP[G9]
MONITORED PARAMETERS				
Pressure				
. PIP	Yes	Yes	Yes	Yes
. MAP	Yes	Yes	Yes	Yes
. PEEP	Yes	Yes	Yes	Yes
Volume				
. Tidal	Yes	Yes	Yes	Yes
. Minute	Yes	Yes	Yes	Yes
. Spontaneous minute	Optional	Yes	Yes	Yes
FiO_2	Yes	Yes	Yes	Yes
Respiratory rate	Yes	Yes	Yes	Yes
Inspiratory time	Yes	No	No	Yes
Expiratory time	Yes	No	No	Yes
I:E	Yes	No	No	Yes
Others	Based on user requirements	Compliance, resistance, Pmin	Compliance, resistance, RSBI, Pmin[G5]	Auxiliary pressure, patient flow, CO_2, compliance, resistance, RQ, VO_2, VCO_2, RSBI, energy expenditure, 14 day trending, alarm logs

	MAQUET	MAQUET	MAQUET	MAQUET
MODEL	**SERVO-I UNIVERSAL**	**SERVO-I ADULT**	**SERVO-I INFANT**	**SERVO-S**
WHERE MARKETED	Worldwide	Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes	Yes
CONTROLS				
Tidal volume, mL	5-4,000	100-2,000	5-350	100-2,000
Insp flow, L/min	0-200	0-200	0-200	0-200
Insp press, cm H_2O	0-(120-PEEP)	0-(120-PEEP)	0-(80-PEEP)	0-(120-PEEP)
Respiratory rate, breaths/min	4-150	4-100	4-150	4-100
Insp time, sec	0.1-5	0.1-5	0.1-5	0.1-5
Exp time, sec	N/A (setting of Ti and breath rate)	N/A (setting of Ti and breath rate)	N/A (setting of Ti and breath rate)	N/A (setting of Ti and breath rate)
I:E ratio	1:10 to 4:1	1:10 to 4:1	1:10 to 4:1	1:10 to 4:1
Insp hold/plateau	Yes	Yes	Yes	Yes
Expiratory hold	Yes	Yes	Yes	Yes
FiO_2, %	21-100	21-100	21-100	21-100
Manual breath	Yes	Yes	Yes	Yes
PEEP/CPAP, cm H_2O	0-50	0-50	0-50	0-50
Pressure support, cm H_2O	0-(120-PEEP)	0-(120-PEEP)	0-(80-PEEP)	0-(120-PEEP)
Nebulizer	Optional	Optional	Optional	Optional
Trigger mechanism	Pressure or flow	Pressure, flow	Pressure, flow	Pressure or Flow
Bias/base flow range, L/min	0,5 (Infant mode); 2 (Adult mode)	2	0.5	2
Pressure slope/ramp adj.	Yes[M1]	Yes[M1]	Yes[M1]	Yes[M1]
ETS				
Sigh	No	No	No	No
100% O_2	Yes	Yes	Yes	Yes
TRC				
OPERATING MODES				
Assist/control				
. Volume breaths	Yes	Yes	Yes	Yes
. Pressure breaths	Yes	Yes	Yes	Yes
SIMV				
. Volume breaths	Yes	Yes	Yes	Yes
. Pressure breaths	Yes	Yes	Yes	Yes
. Pressure support	Yes	Yes	Yes	Yes
Spontaneous/CPAP				
. Pressure support	Yes	Yes	Yes	Yes
Apnea-backup vent	Yes	Yes	Yes	Yes
Others	Automode, PRVC[M2]	Automode, PRVC[M4]	Automode, PRVC[M5]	Non invasive ventilation
EQUIPMENT ALARMS				
Gas supply failure	Yes	Yes	Yes	Yes
Power failure	Yes	Yes	Yes	Yes
Vent inoperative	Yes	Yes	Yes	Yes
Low battery	Yes	Yes	Yes	Yes
Self-diagnostics	Yes	Yes	Yes	Yes
Others	Battery failures, technical failures, automated pre-use check	Battery failures, technical failures, automated pre-use check	Battery failures, technical failures, automated pre-use check	Battery failures, technical failures, automated pre-use check
PATIENT ALARMS O_2	Yes	Yes	Yes	Yes
Low minute volume	Yes	Yes	Yes	Yes
Low inspir pressure	N/A	N/A	N/A	N/A
High pressure	Yes	Yes	Yes	Yes
Loss of PEEP	Yes	Yes	Yes	Yes
Apnea	Yes	Yes	Yes	Yes
HCP/O	Yes	Yes	Yes	Yes
Inverse I:E	N/A	N/A	N/A	N/A
High respir rate	Yes	Yes	Yes	Yes
High minute vol	Yes	Yes	Yes	Yes
High PEEP	Yes	Yes	Yes	Yes
Others	$etCO_2$, patient flow over-range and excessive leakage in NIV	$etCO_2$, patient flow over range and excessive leakage in NIV	$etCO_2$, patient flow over range and excessive leakage in NIV	Patient flow over range and excessive leakage in NIV
MONITORED PARAMETERS				
Pressure				
. PIP	Yes	Yes	Yes	Yes
. MAP	Yes	Yes	Yes	Yes
. PEEP	Yes	Yes	Yes	Yes
Volume				
. Tidal	Yes	Yes	Yes	Yes
. Minute	Yes	Yes	Yes	Yes
. Spontaneous minute	Yes	Yes	Yes	Yes
FiO_2	Yes	Yes	Yes	Yes
Respiratory rate	Yes	Yes	Yes	Yes
Inspiratory time	Yes	Yes	Yes	Yes
Expiratory time	N/A (setting of Ti and breath rate)	N/A (setting of Ti and breath rate)	N/A (setting of Ti and breath rate)	N/A (setting of Ti and breath rate)
I:E	Yes	Yes	Yes	Yes
Others	Lung mechanics, CO_2, open lung tool for lung recruitment, pressure and flow volume waveforms, trended data, loops with reference loop[M3]	Lung mechanics, CO_2, open lung tool for lung recruitment, pressure and flow volume waveforms, trended data, loops with reference loop[M3]	Lung mechanics, CO_2, open lung tool for lung recruitment, pressure and flow volume waveforms, trended data, loops with reference loop[M6]	Pressure and flow volume waveforms, trended data, loops, event log and service log, pause airway pressure, end expiratory flow, end[M7]

Healthcare Product Comparison System

	ECRI RECOMMENDED SPECIFICATIONS[1]			
MODEL	**BASIC IC VENTILATOR**	**EVITA 2 DURA**	**EVITA 4**	**EVITAXL**
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
CONTROLS				
Tidal volume, mL	50-2,000	3-2,000 w/NeoFlow	3-2,000 w/NeoFlow	3-2,000 w/NeoFlow
Insp flow, L/min	3-180	6-180	6-180	6-180
Insp press, cm H_2O	0-80	0-80	0-80	0-95
Respiratory rate, breaths/min	6-120	0-150	0-150	0-300
Insp time, sec	0-3 pause	0.1-30	0.1-30	0.1-30
Exp time, sec	1-8	0.1-30	0.1-30	0.1-30
I:E ratio	1:4 to 4:1	1:300 to 300:1	1:300 to 300:1	1:300 to 300:1
Insp hold/plateau	0-3 sec	Yes	Yes	Yes
Expiratory hold	0-3 sec	Yes	Yes	Yes
FiO_2, %	30-90	15-100	15-100	15-100
Manual breath	Yes	Yes	Yes	Yes
PEEP/CPAP, cm H_2O	0-45	0-35	0-35	0-50
Pressure support, cm H_2O	0-45	0-80	0-80	0-95
Nebulizer	Optional	Yes	Yes	Yes
Trigger mechanism	Flow, pressure, both	Flow (pressure)	Flow (pressure)	Flow (pressure)
Bias/base flow range, L/min	1-20	Not specified	Not specified	Not specified
Pressure slope/ramp adj.	Yes/yes	Yes/yes	Yes/yes	Yes/yes
ETS				
Sigh	Optional	Yes	Yes	Yes
100% O_2		Yes	Yes	Yes
TRC				
OPERATING MODES				
Assist/control				
. Volume breaths	Yes	Yes, AutoFlow	Yes, AutoFlow	Yes, AutoFlow
. Pressure breaths	Yes	Yes	Yes	Yes
SIMV				
. Volume breaths	Yes	Yes	Yes	Yes
. Pressure breaths	Optional	Yes	Yes	Yes
. Pressure support	Yes	Yes	Yes	Yes
Spontaneous/CPAP				
. Pressure support	Yes	Yes	Yes	Yes
Apnea-backup vent	Yes	Yes	Yes	Yes
Others	User preference	Opt independent lung ventilation[D1]	Opt independent lung ventilation[D2]	Opt independent lung ventilation[D3]
EQUIPMENT ALARMS				
Gas supply failure	Yes	Yes	Yes	Yes
Power failure	Yes	Yes	Yes	Yes
Vent inoperative	Yes	Yes	Yes	Yes
Low battery	Yes	Yes	Yes	Yes
Self-diagnostics	Valve leak, sensor failure	Yes	Yes	Yes
Others	By user requirements	Exhl valve, flowsensor insertion, leak, compliance	Exhl valve, flowsensor insertion, leak, compliance	Exhl valve, flowsensor insertion, leak, compliance
PATIENT ALARMS O_2	Yes	Yes	Yes	Yes
Low minute volume	Yes	Yes	Yes	Yes
Low inspir pressure	Yes	Yes	Yes	Yes
High pressure	Yes	Yes	Yes	Yes
Loss of PEEP	Optional	Yes	Yes	Yes
Apnea	Yes	Yes	Yes	Yes
HCP/O	Yes	Yes	Yes	Yes
Inverse I:E	Yes	Yes	Yes	Yes
High respir rate	Yes	Yes	Yes	Yes
High minute vol	Optional	Yes	Yes	Yes
High PEEP	Optional	Yes	Yes	Yes
Others		High tidal volume	High tidal volume	High tidal volume
MONITORED PARAMETERS				
Pressure				
. PIP	Yes	Yes	Yes	Yes
. MAP	Yes	Yes	Yes	Yes
. PEEP	Yes	Yes	Yes	Yes
Volume				
. Tidal	Yes	Yes	Yes	Yes
. Minute	Yes	Yes	Yes	Yes
. Spontaneous minute	Optional	Yes	Yes	Yes
FiO_2	Yes	Yes	Yes	Yes
Respiratory rate	Yes	Yes	Yes	Yes
Inspiratory time	Yes	Yes	Yes	Yes
Expiratory time	Yes	Yes	Yes	Yes
I:E	Yes	Yes	Yes	Yes
Others	Based on user requirements	Optional occlusion pressure, NIF, RSBi, capnogram[D4]	Optional occlusion pressure, NIF, RSBi, capnogram[D4]	Optional occlusion pressure, NIF, RSBi, capnogram[D4]

	HAMILTON MEDICAL	HAMILTON MEDICAL	VIASYS HEALTHCARE	VIASYS HEALTHCARE
MODEL	**GALILEO**	**RAPHAEL**	**AVEA**	**VELA COMPREHENSIVE**
WHERE MARKETED	Worldwide	Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes	Yes
CONTROLS				
Tidal volume, mL	10-2,000	50-2,000	2-2500	50-2,000
Insp flow, L/min	1-180	0-180	0.4-30, 1-75, 3-150	10-140/180 spont max
Insp press, cm H_2O	0-100	0-50 above PEEP/CPAP	0-80, 0-90	0-100
Respiratory rate, breaths/min	1-120	0-80	1-150, 1-120	2-80
Insp time, sec	0.1-9	0.1-9.6	0.15-3, 0.2-5	0.3-10
Exp time, sec	20-90% cycle time	20-90% cycle time	Depends on rate	Depends on rate
I:E ratio	1:9 to 4:1	1:9 to 4:1	APRV allows 30:1	APRV 30:1
Insp hold/plateau	0-70% cycle time	0-70% cycle time	0-6 sec	Off, 0.1-6 sec
Expiratory hold	10 sec max	Not specified	3-20 sec	0-6
FiO_2, %	21-100	21-100	21-100	21-100
Manual breath	Yes	Yes	Yes	Yes
PEEP/CPAP, cm H_2O	0-50	0-35	0-50	0-35
Pressure support, cm H_2O	0-100	0-50 above PEEP/CPAP	0-80 neo/0-90 ad/ped	Off, 1-60
Nebulizer	Yes	Yes	20 min	Off, 1 to 60 min
Trigger mechanism	Flow and pressure	Flow	Flow, pressure	Flow w/press backup
Bias/base flow range, L/min	Automatic	0-10	0.4-5	10-20
Pressure slope/ramp adj.	0.25-200 msec	50-200 ms	0-9 relative scale	No
ETS		5-70%		
Sigh	Yes	Yes	Yes	Yes
100% O_2	Yes	Yes	Yes	Yes
TRC	Yes	Yes (ET tube or track tube 0-10%)		
OPERATING MODES				
Assist/control				
. Volume breaths	Yes	Yes	Yes	Yes
. Pressure breaths	Yes	Yes	Yes	Yes
SIMV				
. Volume breaths	Yes	Yes	Yes	Yes
. Pressure breaths	Yes	Yes	Yes	Yes
. Pressure support	Yes	Yes	Yes	Yes
Spontaneous/CPAP				
. Pressure support	Yes	Yes	Yes	Yes
Apnea-backup vent	Yes	Yes	Yes	Yes
Others	AVtS, ASV, DuoPAP+, DuoPAP[H1]	APRV, DuoPAP+, NIV, ASV	APRV/BiPhasic, TCPL, PRVC[V1]	APRV BiPhasic w/PSV[V2]
EQUIPMENT ALARMS				
Gas supply failure	Yes	Yes	Yes	Yes
Power failure	Yes	Yes	Yes	Yes
Vent inoperative	Yes	Yes	Yes	Yes
Low battery	Yes	Yes	Yes	40% and 20% warnings
Self-diagnostics	Yes	Yes	Yes	Yes
Others	Technical faults	Technical faults	Fan failure, safety valve open, invalid gas ID, ILV disconnect, heliox loss	Test for lamp, leak, switch, alarm, and filter; touchscreen calibration
PATIENT ALARMS O_2	Yes	Yes	Yes	Yes
Low minute volume	Yes	Yes	Yes	Yes
Low inspir pressure	Yes	Not specified	Yes	Yes
High pressure	Yes	Yes	Yes	Yes
Loss of PEEP	Yes	Yes	Yes	Low pressure
Apnea	Yes	Yes	Yes	Yes
HCP/O	Yes	Yes	Yes	Circuit fault
Inverse I:E	Not specified	Yes	Yes	No
High respir rate	Yes	Yes / low respir rate: yes	Yes	Yes
High minute vol	Yes	Yes / low minute vol: yes	Yes	Yes
High PEEP	Not specified	Not specified	N/A	Yes
Others	Disconnection	Disconnection	None	None specified
MONITORED PARAMETERS				
Pressure				
. PIP	Yes	Yes	Yes	Yes
. MAP	Yes	Yes	Yes	Yes
. PEEP	Yes	Yes	Yes	Yes
Volume				
. Tidal	Yes	Yes	Yes	Yes
. Minute	Yes	Yes	Yes	Yes (VTI, VTE)
. Spontaneous minute	Yes	Yes	Yes	Yes
FiO_2	Digital	Digital	Yes	Yes
Respiratory rate	Yes	Yes	Yes	Yes
Inspiratory time	Yes	Yes	Yes	Yes
Expiratory time	Yes	Yes	Yes	Yes
I:E	Yes	Yes	Yes	Yes
Others	Insp/exp peak flow, compliance, insp/exp resistance, time constants, patient trigger, air trapping, aux pressure	Insp/exp peak flow, compliance, exp resistance, leak	Vti/kg, Vte/kg, spont Vte	High and low PIP, high rate, safety valve open, spont & mandatory minute and tidal volumes, Ti (sec), Te (sec)



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ICU **design** – does it matter?

Professor Flaatten explains how design can affect patient outcome, and reports data collected from a temporary ICU set-up during reconstruction of his ICU at Haukeland University.

Does design matter? Intuitively most intensivists would probably answer yes to this question, given the experience we all have from various designs and functions in our daily life. Anyone who has tried to use a nail without a hammer appreciates the effect of using the proper tool for the job! The whole ICU is our "tool" for treating critically ill patients, and is more than the mere sum of various equipment and personnel, but also the size, form and shape of the area in which we work.

Although "evidence based" hospital and ICU design is a hot topic (www.healthcaredesignmagazine.com), the evidence for a possible impact of ICU design on patient outcome is not easy to find in the literature, or to document. By chance, in our own unit, a 10 bed general ICU in a Norwegian university hospital, we recently experienced the opportunity to study the effects of moving from our unit to another location in the hospital (Flaatten 2005), and our experiences may be of interest in this context.

Some years ago it was decided to rebuild our ICU (the only general ICU in the hospital) to improve its function and design. The most important issues were lack of enough power supply including adequate uninterrupted backup power, pure water for haemodialysis and lack of proper isolation rooms within the ICU. During the reconstruction (which involved a complete stripping of the interior), we had to move out of the area. A temporary ICU was established in one of our postoperative rooms for a period of 9 months, from July 2001 to February 2002. Equipment and personnel remained consistent, but operated in one large room, with difficult access to storage, offices and resting areas, and with no facilities for relatives. After moving back we noticed a slight increase in mortality (yearly report 2001), and decided to have a closer look at the whole 9 month period compared to the prior and following 12 month periods.

Using our traditional analysis with standard mortality ratio, we found an increase, but because of the small numbers of patients, the confidence intervals were rather large. Using another technique, the so-called variable life adjusted display (VLAD; Lovegrove 1997), a very clear picture appeared, illustrating a clear shift in mortality during the whole period of rebuilding (Flaatten 2005). Since this was a retrospective analysis, it was difficult to find specific reasons for the increase in mortality. The case mix, severity of illness, treatment modalities and personnel had remained the same. We had to conclude that the observed increase in mortality was a poorly explained result of moving to another area, never intended to be used as an ICU. This temporary area had consisted of one large room, compared to several one- and two bed rooms in the ICU, had very little daylight, and nearly half the average area per bed (15m^2 compared to 25 m^2).

How is it possible for ICU design to influence outcome? There are no definite answers to this question, but some interesting findings exist. More than 20 years ago, it was shown that postoperative patients who were given a room with a view of natural surroundings suffered fewer complications, used less pain medication and were discharged sooner than those with a view of a brick wall (Ulrich 1984). Although not directly applicable to many ICU patients, this study in fact documents an effect on outcome from how the rooms are constructed. There is also evidence that transmission of bacteria from patient to patient increases with the number of beds in the room (inversely related to the distance between beds) (Kibbler 1998, Borg 2003). There may also be effects of noise and use of colour, but these are more difficult to find evidence for in an ICU population.

The design of the ICU undoubtedly affects how we work as health professionals. Staff satisfaction and turnover may be influenced by the working conditions, and could ultimately influence how patients are treated and quality of care. Knowledge about effects of design and functionality on outcome are essential. This article is the first in an ICU Management series, which will discuss optimal design of the ICU.

Invitation

The call for papers in this series is still open. Write to: editorial@icu-management.org.

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Effective **communication**

Recent research is informing on the impact of poor communication skills in intensive care practice. Dr Todd Dorman reviews the sources and consequences of ineffective communication and recommends corrective strategies.

Communications series
Conflict and communication - autumn 2005
➤ Effective communication - winter 2005
Communicating with administration - spring 2006

Effective communication is of central importance to sound management in the intensive care unit (ICU). In the ICU as in many areas of medicine, communication skills have not historically been emphasized. Traditionally, medical school or residency curricula have not formally addressed communication. However, the negative impact of poor communication and the benefits of effective communication have been explored recently with increasing frequency. The results of this body of work overwhelmingly support the central role of communication skills in improving aspects of patient care, staff relations and administrative functions. To this end, the Accreditation Council for Graduate Medical Education has recognized the importance of communication where it has been defined as one of six competencies to be incorporated, taught, measured, and evaluated by residency training programs and the residency review committee (Gadacz 2003).

Types of communication

Communication can take a number of forms. Options for communication have been expanded by technology. Examples of various modes of communication include written forms such as written notes in the medical record or physician's orders, verbal communication including face-to-face discussion, telephone conversation or voice-mail, and electronic communication such as e-mail or text pagers. One must consider inherent potential problems when certain technologies are relied upon for communication. With e-mail, voice-mail, and text pagers there is often no way to confirm if a message was received in a timely fashion. Also, the type of paging system in use is important in determining response times during times of crisis (Moss et al. 1999).

Frequent communication patterns in the ICU

A variety of communication patterns can exist in the ICU. The types of relationships involved may influence the frequency of use of various modes of communication and have significant implications for the importance of different communication styles and skills to achieve the goals desired. Patterns include communication between the healthcare team and the patient or patient's family. This may take the form of physician, nurse, or other allied health consultant discussing issues with the patient or a family representative. Other important patterns include communication between members of the healthcare team. This can include communication between:

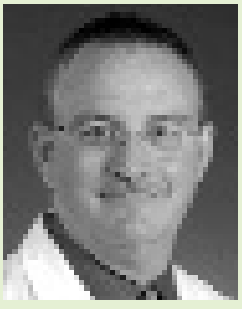
- a physician and nurse
- physicians on the ICU team with the possibility that physicians may be equal, superior or subordinate in a hierarchical system
- nurses who may also be in an equal, subordinate or superior role
- the ICU team and various primary services or consultants.

Sources of ineffective communication

It is widely believed that physicians tend to overestimate the strength of their communication skills. Limitations in interpersonal and communication skills are perhaps the single issue interfering with effective communication across all patterns mentioned above. The causes for poor communication skills are multi-factorial. Some personality styles and managerial styles may be deleterious to effective communication including overly domineering, insensitive or overly passive personality traits. Lack of recognition that poor communication is a problem may lead to lack of attention in listening to the other side of a debate or understanding the concerns of the other party. This may be especially true when discussing clinical conditions with patients and their families (Gadacz 2003).

Studies have documented that while on rounds in the ICU the care team spends a significant amount of time in direct communication. However, a significant number of interruptions occur (Alvarez and Coiera 2005). These interruptions may come from outside the team or within. The time spent dealing with interruptions approaches one third of all time spent in direct communication. It is clear that some interruptions are necessary in the efficient care of patients, but it is not known if excessive interruptions interfere with patient care. Frequent interruptions are known to have the potential to disrupt working memory and generate error.

Several studies have reinforced the notion that difficulties remain in communication across hierarchy, especially when subordinates attempt to provide information and suggestions to superiors (Coombs and Ersser 2004).



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Thomas et al. (2003) surveyed physicians and nurses in the ICU and noted significant differences in their perceptions regarding teamwork. The core issues involved aspects of communication. Nurses relative to their physician counterparts believe that it is more difficult to speak up if they perceive a problem with patient care, disagreements regarding what is best for the patient are not appropriately resolved, input from nurses about patient care is not well received, and more input from other ICU personnel is needed for sound decision-making. A survey examining how providers work together in the neonatal intensive care unit identified communication as an important group influence specifically noting the importance of skill and style of questions, documentation and sharing of information, integrity and accountability, along with communicating across hierarchy as key elements (Thomas et al 2004). Sexton et al. (2000) surveyed attitudes of operating room and ICU teams regarding error, stress and teamwork as compared to aviators. Medical personnel demonstrated attitudes that were potential barriers to effective communication across hierarchies and importantly obstructed recognition and discussion of error.

Communication has also been identified as a critical element in discussing unfavourable clinical information with patients and their families. Delivering "bad news" can be very difficult for some providers. Fins and Solomon (2001) have noted the importance of using clear but sensitive language in the right setting at the right time. The burden is on the clinician to possess self-awareness regarding their own shortcomings in communication and insight to avoid undermining trust of the patient and their family. Unfortunately, this rarely happens. Sexton et al. (unpublished personal communication) have noted that ICU physicians believe they are collaborative with other healthcare team members about 90% of the time, whereas other healthcare team members believe the physicians are collaborative only 50% of the time. The difference in perception of these groups seems to be definitional. Physicians seemingly define collaboration as "the physician says and someone does it".

Consequences or ineffective communication

The consequences of poor communication include increased risk of harm to patients, deterioration of working conditions leading to increased staff stress and burnout, and problems with trust and therapeutic relationships with patients and their families. Donchin et al. (2003) identified poor communication between physicians and nurses as a significant source of error. Problems were identified with both written and verbal communication. Communication and leadership have been documented as skills lacking in teams responding to cardiac arrest (Marsch et al. 2004; Pittman et al. 2001). While the impact on ultimate patient outcome is not known, empirically it is undesirable to have a breakdown in leadership and communication during times of crisis.

Communication for improved patient outcome

Fortunately, communication skills can be improved if the problems are identified and acknowledged. In fact, several studies have demonstrated positive outcomes of initiatives designed to improve communication and promote an environment of safety. Pronovost et al. (2004) identified aspects of communication between team members that may contribute to untoward events. Verbal or written communications during hand-over of care, during routine care, and during crisis were identified as problematic. Team structure and leadership were also identified as potential barriers to effective communication. In response to adverse events, a Web-based anonymous reporting system was created to allow incident reporting with the potential to learn from adverse events and near misses with the ultimate goal of identifying and solving system problems.

> ... healthcare team members believe physicians are collaborative only 50% of the time

In addition to individual awareness about personality traits and styles that may impact on effective communication, other tools may enhance communication with a positive result on patient care. Use of a daily goal sheet in the ICU has been proposed as an effective technique in ensuring all team members understand the daily goal of care, and has been associated with reductions in length of stay in the ICU (Pronovost et al. 2003). Important benefits of the strategy included encouraging interdisciplinary communication and increasing awareness of potential mechanisms of patient harm. The goal sheet can also be used to facilitate communication between the healthcare team and the patient or their family.

Conclusions

Good communication is central to effective management in the ICU. A variety of modes and patterns of communication are frequently encountered in the ICU environment. Effective communication skills are not necessarily innate. It is the responsibility of healthcare providers and managers to recognize potential shortcomings in communication and take corrective action. The quality of communication can have a profound influence on patient care, staff attitudes and effectiveness, and implementation of administrative initiatives.

Care of the **deceased patient** and the **bereaved family**

Maureen Ben-Nun and her colleagues have researched, developed and implemented a protocol for the care and respect of the bodies of deceased patients, to help families during the period of bereavement. This project was awarded the 2003 Professor Bergman prize for Creativity in Nursing by Tel Aviv University.

When a patient dies in intensive care, the patient's body remains connected to machines and technology. The dead body and the newly bereaved family must be cared for and legal and bureaucratic requirements met. The family must be informed and allowed a dignified parting from the deceased. All this must be managed while the routine activities of the unit and care of other patients continue. The staff has a delicate task to perform when besieged by feelings of sadness and failure (Brenner 2002). This article describes how we have developed and implemented a protocol to manage the time from the patient's death until the discharge of the body to the morgue.

Researching, implementing and evaluating the protocol

Before implementing change we researched the issue in house by questioning the 28 nurses in the unit. A majority expressed the need for improved knowledge on how to care for the deceased patient and bereaved family and felt that the existing guidelines did not allow the families a dignified parting from the deceased. They considered themselves inadequately informed as to the bureaucratic process and therefore unable to guide the family.

Recognizing the role of the nursing profession in this area, we researched and developed a protocol with guidelines (see table 1 on page 34). We explained these guidelines to all staff at a staff meeting and in individual training sessions. The protocol was designed to improve the care of the bereaved family during the hours after the patient's death and thus as a tool to help staff cope with the needs of the family. It would explain the bureaucratic process necessary after the patient's death, with a checklist available for efficiency, guidelines to consult in case of uncertainty and a pre-prepared kit with all the requisite documents and forms. After one year we questioned the staff again on the issue of caring for the deceased and all staff felt an increased ability to cope.

We also contacted families of bereaved patients during that year to evaluate their level of satisfaction and thus the effectiveness of the protocol. 16 from a total of 31 families bereaved in the preceding year were contacted by telephone. All agreed to answer the questions. 13 families had been cared for according to the protocol and all expressed extreme satisfaction.

Contributing factors to their satisfaction were:

- the supportive atmosphere in the unit;
- being able to take a decent leave of their relation;
- patience and kindness shown by the staff, even during the most stressful times;
- appreciation of messages of condolence.

The remaining three families had not received any care. Their relations had died at night, they were not formally informed, and their last encounter with the patient had taken place in the morgue. These families were extremely dissatisfied, with a zero level of satisfaction. From their testimony the following conclusions were reached:

- avoid telephone notification;
- avoid delays in notification;
- arrange for the family to say their farewells in the unit, never in the morgue.

Rationales for the guidelines

Notifying the family

Families need to be informed in a clear, unequivocal manner that the patient has died. This helps families move on from possible denial and initial shock to a phase of recognition that the patient has died (Hudak et al. 1998). Providing privacy and attendance of a doctor and a nurse show the staff's caring attitude. This respect helps to disarm the anger often present in the initial stages of mourning (Kubler-Ross 1969). Formality of approach provides boundaries so that everyone present can feel safe, even in the potentially chaotic circumstances of death. The explanation as to the causes of death can prevent later disturbances in the grieving process, caused by families not understanding why the patient died (Azouli 2002).

Caring for the body

During their farewells, the family can reclaim the patient as their own, however briefly. To see a loved one's face, dead and at peace may be the first step in the grieving process and may prevent denial from continuing. It is well documented that families of ICU patients have difficulty recognizing their loved ones when they are attached and disfigured by lines, tubes and machines. The immediate removal of redundant lines and presenting the body gracefully is therefore essential (Perry 2002).

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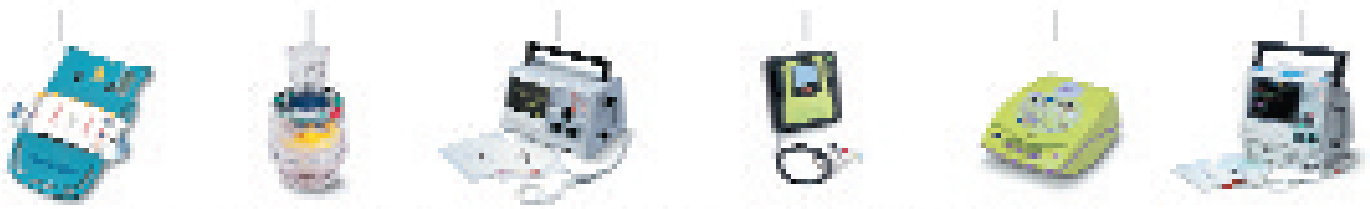

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Table 1. Protocol from the death of a patient until the discharge of the body to the morgue	
The patient's death	Confirm the patient's death by a 12 lead Electrocardiogram
	Record the time of death as printed on the ECG tracing
	Notify ICU and hospital management, and all ICU staff
	Maintain a quiet respectful atmosphere
Notifying the family	Request the family to come to the unit
	Greet the family on arrival and escort them to a conference room or a doctor's office
	If the families are present at the bedside at the moment of death, take them gently to the room for the official notice
	A doctor should give the notice, with a nurse present
	The family should be seated and the nurse should remain with the family to provide support
	Tell the family the time of death, and the causes of death, as documented on the official documents
	Medical language should be translated as necessary to help understanding
	Provide water to drink and tissues to wipe away tears
Caring for the body	Straighten the body and elevate the head of the bed to 30 degrees; this allows reduction of swelling, and reduced bleeding from the face and upper body
	Remove all tubes and lines
	Clamp catheters with a high tendency to bleed, such as dialysis and femoral arterial lines, as close to the skin as possible, and cover with gauze
	Comb hair and wash the face free of secretions
	Keep the patient between clean sheets (i.e. not placed in the body bag for transferring to the morgue)
	Change sheets if necessary
	Support the jaw and close the patient's eyes
	Check that the patient's bed and surroundings are clean and tidy
	Move all machinery away and switch off all monitors
	Cover the patient leaving a hand on top of the sheet, preferably the wedding ring hand, if appropriate and not physically disfigured in any way
Saying goodbye	Draw the curtains to ensure privacy
	Check that seating is available
	Escort the family to the bedside and allow as much time as they need to say their farewells
	A nurse should remain present to offer support as necessary
	If family members become overemotional, gently escort them back to the room made available to them
The bureaucracy	The doctor is responsible for filling in the relevant forms
	The nurse is responsible for guiding the family through the process
	A pre-prepared envelope of all the required forms should be used
After the family have left	Place the patient's body in the body bag, correctly labelled and transfer to the morgue
	Continue consideration of other patients and families; maintain the dignity and respect for the deceased
	Send a letter of condolence as a final gesture from the unit to the bereaved families

Saying goodbye

The family's parting belongs to the family and the patient. A sympathetic and calm presence can be felt across cultural and language divides.

Bureaucracy

The family may well be in shock, and need guidance as to the next steps to be taken. Incorrectly filled in forms may result in distressing complications for the bereaved.

Conclusions

Following adoption of this protocol as a policy in our ICU, a new norm of behaviours has been established. The respectful, considerate care of the dead is no longer left to the goodwill of an individual staff member, but is enshrined in unit policy, with all staff expected to conform, and all staff contributing to the outcome. The formal protocol protects from dilution or avoidance due to outside pressures, such as patient turnover, or internal pressures such as emotional distancing by a staff member. The Unit culture of calmness and compassion in the presence of death liberates those who are capable of composure to act, and protects those who feel threatened. With all staff members clear about their duties, the team response to the death of a patient is as skilled and effective as when the team is fighting for the patient's life. The protocol allows us to work as a team for our patients until the very end.

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Research questions from **nursing** practice

Nursing research can improve patient care and outcome, promote professional growth and help avoid staff burnout. In this article, Julie Benbenishty describes the steps from asking a research question to completing research. Also in this issue of **ICU Management** (page 34), you can read an article co-authored by Julie Benbenishty, Maureen BenNun and colleagues, describing a research project, which was awarded the 2003 Professor Bergman prize for Creativity in Nursing by Tel Aviv University.

Research provides the opportunity to further knowledge, to gain recognition in setting standards for patient care and nursing practice, and to grow personally and professionally. By participating in research projects, nurses improve nursing practice and patient care and become leaders in their own departments. Nurses can lead the entire research process from developing a research question through to data collection and analysis, and the publication process. Once published, nurses have the opportunity to present their findings at national and international meetings, thereby influencing patient care and nursing practice at a global level. Completing research can also improve the quality of life for the working team. With the promotion of nursing research, the burnout rate is greatly reduced and nursing staff tend to stay in the unit (Burtt 1999).

Approaching nursing research

The main requirements for nursing researchers are an enquiring mind and interest in looking for ways to improve patient care. Nurses, above all other healthcare providers, have the best opportunity to identify problems and patterns of patient behaviours and to observe patient responses to therapy. Although there is much professional literature to support provision of patient care, too often there are gaps in the literature for the specific problems that nurses are dealing with, and for which better procedures are required. (The article opposite in this issue of **ICU Management** describes how to appraise evidence from the literature.)

Recognizing patterns and problems allows us to ask questions about how care can be improved. Nurses, regardless of academic background, must be able to identify what needs to be changed and what we don't know about the patterns observed with patients. This is the first step towards developing a research question.

The next step is to understand the resources available to explore the research question and help find the answers. Nurses approaching research need to believe that what they have to say is important and to identify the key contacts to progress their ideas. They need to invite collaborators who are also interested in the topic or issue, and who have been actively involved in developing research, and have the academic credentials to develop a study. The prospect of developing research may be frightening for nurses who are not familiar with the process. However, the best research is most often a group effort; research cannot be achieved alone. The ICU nurse who is motivated to perform research must involve his or her nursing team and other staff members sharing the same goal. Table 1 lists all the steps as a checklist for nurses to progress towards completing research.

Nursing research investigates topics that relate directly or indirectly to nursing, affect nursing practice and influence the lives of patients and practitioners. Nursing research can be descriptive, quasi-experimental or experimental. It can be conducted through quantitative or qualitative methodologies and may be retrospective, prospective or longitudinal in design. Research findings determine how nurses deliver care, educate each other, and manage their practice. With evidence-based nursing practice, patients are more likely to receive nursing care that is safe and effective, promotes comfort and the best outcomes.

Table 1. Checklist for approaching nursing research

Observation - Identify patterns and problems - Question - Identify the research question - Believe in what you have to say - Share ideas in discussion - Identify key contacts to progress the research - Invite interested and experienced collaborators - Involve all team members - Data collection - Data analysis - Publication - Application

The Nightingale Legacy – research and practice

In Nightingale's view, nursing should be a search for truth. She believed that the ability to collect accurate information and make correct observations was essential. "If you cannot get the habit of observation one way or other, you had better give up being a nurse, for it is not your calling, however kind and anxious you might be" (Nightingale 1969). Nursing research gathers evidence for good practice to improve healthcare and can also promote team spirit and professional development.

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How to read a paper: **critical appraisal** of research

Evidence-based medicine (EBM) has been defined as the integration of individual clinical expertise and best external evidence from research (Sackett et al. 1996). The process involves: (1) asking a clinical question (2) searching for evidence to answer it (3) appraising the evidence and (4) integrating it into practice. However, each step needs skill and practice to make EBM 'work'. Julie Benbenishty (opposite on page 38) has provided a checklist for nursing research, which relates to step 1. Here we focus on how to make sense of published research (step 3).

Research to practice series

Perception and practice, autumn 2005

Research questions from nursing practice (opposite)

➤ Appraising the evidence

Outcome measures

Evidence to practice

Types of evidence

Primary research may take the form of randomised controlled trials (RCTs), observational studies, case series/reports or laboratory investigations. Some types of research design are thought to be less prone to bias. Journals publish review articles too, and there is a move towards the preparation of systematic reviews, to try to avoid bias here also. It is now common to grade the strength of evidence according to how robust, (that is, free from bias) it is likely to be (see table 1). Systematic reviews and RCTs give the highest quality evidence, and clinical practice should be based on these whenever possible (Meeran & Grocott 2005), although this may not be so straightforward in ICU practice (Vincent 2004).

Table 1. Simplified hierarchy of evidence (modified from www.cebm.net/levels_of_evidence.asp)

Level	Study Type
1	Systematic review
2	Randomised controlled trial
3	Observational studies
4	Case series or case reports
5	Expert opinion / based on physiology, bench research or 'first principles'

Making sense of a randomised controlled trial

Overview - Here we illustrate the principles for the RCT. The three main principles are logic, validity and applicability. The first is evident from reading the paper as a whole, but the other two are apparent from the 'methods' section, which is often missed by readers in their rush to read the results!

Logic - Does the study seem to 'flow' from the starting idea or hypothesis? Has the right question been asked? Is the method appropriate for the question, and do the results follow from the methods? Lastly, does the discussion deal with the good and bad points of the study accurately and does the conclusion actually follow from the results? No amount of statistical manipulation can save a poorly thought-out study!

Validity - Is the study any good? If there are flaws in the methodology of the trial then the conclusions cannot be relied upon. For a RCT the most important determinants of quality are:

- Randomisation is important to reduce bias; randomised trials give stronger results. Method of randomisation should be explained (some methods may not actually be random!), and there should be 'allocation concealment'. Clinicians should be unaware of how patients were allocated.
- Control Groups: depending on what is being studied the control group(s) should consist of a placebo group and/or another recognised intervention that is known to be effective.
- Blinding: ideally, both patients and clinicians should be blinded to the intervention (termed a double-blind study), but this is not always possible (use of tracheostomy for example). It is usually possible however to ensure that those assessing clinical outcomes are blinded to the treatment received.
- Analysis: the more patients are lost in follow-up, the weaker the study. The correct analytical method to adjust for this is called 'intention to treat' analysis, where patients should be analysed in the group into which they were randomised, even if their treatment changes during the study period.

Any baseline differences between study groups, and the contaminating effect of other treatments should also be noted.

Applicability - Are the patients like mine? Enough detail should be given for readers to decide if the study patients are similar enough for the results to be more widely applicable. As suggested above, researchers are more likely to end up with clinically irrelevant results, if they ask a clinically irrelevant question at the beginning of the study!

Further information

Many printed and electronic sources of guidance on how to read research reports are available (see for instance http://www.cche.net/usersguides/main.asp or Greenhalgh 2000). Some are more complex than others, but we believe that keeping the above 3 simple principles in mind will serve as an excellent starting-point. Future articles in this series will cover more specific topics in more detail.

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Management of **MRSA**

Dr Bellingan presents his viewpoint on the isolation of MRSA patients in intensive care.

Overview

There is little unanimity in the management of MRSA. I believe that we must use the best evidence available and, where lacking, we should continue with common sense approaches until we have thoughtfully challenged unfounded concepts. If these are found wanting we must not be afraid to adopt new strategies.

Hand hygiene

Currently recommendations are for staff to clean their hands before and after patient contact and after removing their gloves. Staff should wear gloves and aprons when in contact with patient body fluids and change them between patients. A problem not really addressed is the high frequency of staff-patient contact in the ICU. Observations demonstrate 20 to 40 contacts per hour, which could require up to 30 minutes in hand hygiene! This could explain the universally woeful hand hygiene compliance of only 10 to 40%. But which are true "high risk" staff-patient contacts? Do these include comfort measures such as holding the patient's hand or only contact with open wounds, body fluids etc? Should staff undertake hand hygiene between touching the local environment and contact with the patient? A manageable hand hygiene frequency focused on real risk may improve compliance.

There is little evidence on how or how often a patient's environment should be cleaned. We need to assess the importance of environmental MRSA contamination in transmission. We may need to dramatically increase the cleaning frequency and/or cleaning methods to avoid environmental transmission.

Elective surgical cases

In my view there should be a different approach to screening of elective surgical cases to that for general critical care patients. Elective patients should have pre-admission screening and, if positive, should have Mupiricin cream and Chlorhexidine washes commenced prior to admission. This will significantly reduce wound infection and, by restricting to specific patients, avoid resistance. I recommend continuing to isolate patients with MRSA in elective surgical units, at least until this measure is proven ineffective.

General critical care patients

For general critical care patients I advocate screening of all patients on admission, weekly and on discharge, and using this data for an ongoing audit of MRSA levels, which is vital if changes in management policy are to be introduced. Current screening techniques are relatively insensitive and can take days to identify MRSA, which does not allow rapid responses.

A Cochrane review concluded that there is insufficient evidence to support antimicrobial therapy for eradication of MRSA. Although Mupirocin has been shown to be effective, recolonisation and resistance limit its widespread use. In the absence of an effective policy for decontamination, the only other approach is isolation. Our recent study suggests that isolation of patients colonised with MRSA, when in a unit with endemic MRSA (as most UK ICUs are), does not work (Cepeda et al 2005). This, coupled with high bed occupancy rates, makes it difficult to adopt a policy of isolation.

Furthermore, isolation may not be harmless; studies show that it may provide a barrier to care with reduction in staff-patient contact time, despite isolated patients having higher APACHE II scores than non-isolated patients. In another study, the incidence of MRSA rose 8-fold during the SARS outbreak in Hong Kong (Yap et al 2004), which further challenges our ideas on isolation, hand hygiene and contact precautions.

Currently screening focuses on the nose. However one study has indicated that oropharyngeal carriage occurs frequently and that using oral vancomycin reduces colonisation and MRSA pneumonia, without the introduction of resistance. This topic urgently needs a definitive study and I would not recommend changing practices until new data is available.

Conclusion

Screening for MRSA should be routine for ongoing audit, but only in preoperative elective cases should decontamination be used. The potential for rapid screening (hours rather than days) may allow rapid identification of emergency surgical patients colonised with MRSA prior to surgery, such that decontamination regimes can be instituted for these selected patients prior to theatre. In general, for units with endemic MRSA, isolation probably has no place. Compliance with hand hygiene needs to be increased; this may occur through a better understanding of which contacts pose a high risk, including the importance of the environment in MRSA acquisition.

For details of MRSA management strategies at a national level in the UK, see page 56.

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Author guidelines for ICU Management

Content

Articles may focus on any management or practice issue in intensive care related to economics, quality of care or patient outcome. We only accept scientific papers with a clear connection to management and practice issues. We also invite Viewpoints for publication, which are personal opinions of the author, and Letters to the Editor, which are published at the discretion of the Editors.

Submissions may not have been published previously or be currently submitted for publication elsewhere. Articles must be written by independent authorities and any sponsors for research named. If manufacturers are named in an article, the text must present an unbiased view, not supporting any particular company.

Submission guidelines

Authors are responsible for all statements made in their work, including changes made by the editor and authorized by the submitting author.

The text should be provided as a word document via e-mail to editorial@icu-management.org. Please provide a contact e-mail address for correspondence.

Following review, a revised version, which includes the editors' comments and recommendations, is returned to the author (at the contact e-mail address) for authorization.

Length

Articles: maximum 700 words (less if figures or tables are included)

Viewpoints: maximum 700 words

Letters to the editor: maximum 175 words

Please note that contributions longer than the specified number of words may not be accepted.

Structure

Article texts must contain:

- a title;
- names of authors with abbreviations for the highest academic degree;
- affiliation: department and institution, city an country;
- main authors are requested to supply a portrait photo (see specifications below);
- a summary of one or two sentences (no more than 30 words) describing the content;
- one contact name for correspondence and an e-mail address which may be published with the article;
- website, if appropriate;
- acknowledgements of any connections with a com pany or financial sponsor;
- an introduction, main text and summary/conclusion, with subheadings as appropriate;
- authors are encouraged to include checklists and/or guidelines which summarise findings or recommendations;
- references or sources, if appropriate, as specified below.

Writing style

Articles must be written in English (with English spelling), with short sentences, a clear structure (see above) and without bias. Full stops in numbers may only be used to indicate a decimal place; otherwise use commas as separators.

Images

Main authors are invited to supply a portrait photo for publication with their article. This and any other relevant images for publication with an article should be sent by e-mail as separate files (only high resolution images with 300dpi) and their order of placement in the article must be clearly indicated. Only the electronic formats ".tif" or ".jpeg" can be used for images, i.e. not Microsoft Word or PowerPoint. Images must be no smaller than 9cm x 9cm at 100% scale. Only images meeting these specifications can be published. If an image has been published before, permission to reproduce the material must be obtained by the author from the copyright holder and the original source acknowledged in the text, e.g. "© 2004 Kirstie Edwards".

Format for references

Please use the Harvard reference system. Citations within the text for a single author reference should include the author surname and year of publication; for a citation with two authors include both author surnames and year of publication; for more than two authors, include the first author surname followed by "et al." and the year of publication. Multiple citations should be separated by a semicolon, and listed in alphabetical order.

Example of within text citation: (Edwards 2004; Edwards and Miller 2002; Miller et al. 2003).

The format for listing references in submitted articles should follow the Harvard reference system.

Example of standard journal reference: Sydow Campbell, K. (1999) "Collecting information; qualitative research methods for solving workplace problems", Technical communication, 46 (4) 532-544.

Readers will be provided with an e-mail contact for references, which will be kept on file and supplied on request. Authors are responsible for the accuracy of the references they cite.

Acceptance

It is always at the discretion of our editorial board to accept or refuse submissions. We will respond to submissions within 8 weeks of receipt. We reserve the right to revise the article or request the author to edit the contents, and to publish all texts in any Euromedical Communications journal, on the Internet and to list them in on line literature databases.

Thank you

The ICU Management Editorial Team
editorial@icu-management.org

An interview with Prof **Jacques-Andre Romand**

Jacques-Andre Romand shares his management experiences from a surgical intensive care unit (SICU).

Introduction

Doctor Romand, a practicing intensivist and anaesthesiologist, researches haemodynamics and is responsible for recruitment, education and training in the SICU at Geneva University Hospital. The hospital has over 1000 beds with approximately 8% of the budget dedicated to intensive care. The SICU has 20 beds, 5 attending physicians, 5 registrars and 10 internal residents. The nurse to patient ratio varies but is at least 1:2 during the night. Serving 1600 patients per year, the unit has a mortality rate of 10%.

Table 1. A typical day

0730 – 0800	Preliminary round to assess what needs to be discussed with surgeons
0800 – 0900	Rounds with the surgeons
0930 – 1130	Official rounds in two teams with one resident, one registrar and the nurses
1130 – 1330	Administration: hospital, university, ESICM, organising symposiums...
1330 – 1500	Meetings: discussing patients, administration, lectures
1500 – 1600	Patient visits to ensure that proposed clinical procedures are completed

What are the main directives of your role?

Delegation has allowed me the chance to experience intensive care management, together with my colleague, Bara Ricou. I spend around 60% of my time in clinical practice, 5% in research, 15% on administration, 10% on pregraduate teaching and 10% on personnel issues. I am a specialist on the unit with clinical duties, and for 50% of the time I'm on call 24 hrs, which means I need to reach the hospital within 30 minutes. Apart from clinical work, my main goal is to educate the physicians in ICU. Together with my colleagues, I'm responsible for the core curriculum, organizing education for residents through lectures in our ICU. We also organize regional lectures and day courses. We include clinical bedside teaching, usually on a one-to-one basis, to help trainees learn how to work independently. A specialised registrar or the attending specialist does the rounds with the junior physician. Support is through tutorials and mentor relationships, which work very well. I also review literature and select relevant papers for registrars to study.
Research is also important. My own research – which I love – is in haemodynamics. I'm also the President of the Medical Faculty Council, a reviewer for my specialty at the university, and I'm involved with a humanitarian mission to support training in intensive care in Mongolia. There is also administrative work.

How would a typical day proceed?

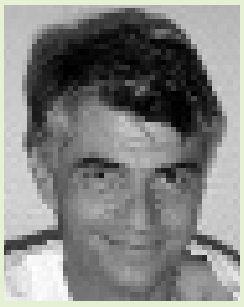
There are two 12½ h physician shifts for both week days and week-ends which change at 0700 and 1930 hours. Two specialists and two interns are present for all shifts except the week-day shifts, when two interns and one specialist are present.
During their rounds with the surgeons, the triage team discusses which patients can be moved out of intensive care, to free up beds for new patients. One attendee and one head nurse share the triage responsibility. Elective surgery accounts for one third of our patients. Although we are a closed unit and responsible for the decisions we take, we liaise closely with surgeons on this. Sometimes with "standby" situations, we have to say "no" to surgery, because no bed is available. This rarely happens, but is very frustrating for patients.

What extremes are there in your role?

There are extremes between clinical, training and administrative tasks; for example between applying high level clinical expertise to medically fine-tune mechanical ventilation, and writing a report for administration to justify why the budget for stationery has been exceeded by 5%. Another example is the contrast between teaching and accompanying a patient to a CT scan because no junior doctor is available.

What skills are essential in ICU management?

Intensive care requires good communication skills. We have open visiting hours from 1100 to 1900 hours, so we can be called on by anyone in the family at any time. Communication is a particularly important aspect with family. You can say almost anything to someone, if you say it correctly. However, an incorrect statement, missed point or unexplained situation can cause major problems. This is true not only for the family, but also within the team. Intensive care is teamwork. Poor communication can damage the nurse–physician relationship. If we experience problems arising from poor communication, we try to teach and encourage the parties to speak together. Otherwise we attempt to arbitrate. Something that takes a few seconds to say may take hours to correct.



INTERVIEWEE
Jacques-Andre Romand
Surgical Intensive Care Unit, Department of Anaesthesiology, Pharmacology and Surgical Intensive Care, Geneva University Hospital

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We try to encourage teamwork in our department, because with the high turnover, as soon as staff members get to know each other, they are moving on. Incoming and outgoing physicians stay from 3 months to 1 year, anaesthesiologists 6 months and more senior attendees 3 to 5 years. The nursing staff is more stable, with a turnover of 6 to 7 years. We try to get people together outside the unit to help with team building.

What is the hardest decision you've had to make?

The hardest thing is to fire somebody. We usually manage to avoid reaching such an extreme situation, however.

What has been the most satisfying experience?

We receive letters from patients or family members thanking the team for the care. This happens also after patients have died; family members tell us that they feel we have done the best that could be done for their loved ones. These letters are rewarding for the whole team. Sometimes particular thanks for the ICU team are even acknowledged in obituaries published in newspapers.

How would you improve your department?

The difficulty we currently have is that the continuity of care is unstable because of the working hours regulations imposed by the state. How do we handle a patient who is staying in the unit for three weeks? If you change the team two or three times per week, important information gathered by the first team may not reach the third one.

The vast quantity of information stored on computers doesn't necessarily help, because physicians can't filter out the information they need. We are looking for a new patient management system to alert with warnings. There are so many possibilities to make mistakes with drug interactions, drug allergies, etc. We need a system to collate information and create expertise, to provide physicians with good relevant information.

We are also testing an alternative solution to overcome difficulties with the new working hours. We aim to achieve an acceptable average over several months to avoid interrupted shifts for the medical physicians. Our system may not be compliant with the law, but it is accepted by the people working in intensive care.

What management training have you followed?

I followed a one year management course and a micro-MBA, which helped me to understand the concepts of budgeting. 80% of our budget is used by human resources, which only leaves a margin of 20%. This will be more important soon because our hospital will be reimbursed by the admitting diagnosis. An appendectomy is covered by a certain amount of money, independent of the variations in complications or length of stay. An understanding of these things helps when negotiating with administrators.

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What financial issues do you deal with?

Companies demonstrate their latest products to a team which includes me, one nurse and one logistic in the ICU. If interesting, we propose the product to a larger team for review, and if there is agreement, the nurses begin formal testing. If the product fits our needs, we add it to the list of things to be budgeted for. Hospital administration doesn't get involved in the choice of equipment.

We budget in advance each year anticipating what we will need. Salary is covered by the state scale, so budgeting is for equipment and drugs alone. If we select a new and more expensive drug to use, we need to account for this in the budget; otherwise the increase in expenditure will be queried. The agreed budget is awarded at the beginning of year, but not fixed to the objects required, which allows some flexibility.

What general issues should ICUs be addressing?

ICU is only a small part of the overall journey of the patient in the hospital. We see now, for example in the RIVERS study (Rivers et al. 2001) that intense haemodynamic management in the first 6 hours following admission can change the life of the patient. Much happens to the patient before and after intensive care. We need to share intensivist expertise for preventive results. For example, if a patient with head trauma has not been treated appropriately by paramedics, even the best ICU in the world cannot change the outcome for the patient.

Thank you, Professor Jacques-André Romand

EUROPEAN INSTITUTIONS - This is the second part in a series which covers the structure and operations of the EU institutions. In the first of the series (autumn 2005) Helicia Herman introduced the European Commission (EC), Peter Arlett explained how regulations are proposed and details of the EC Directorate-Generals relevant to intensive care professionals were presented.
This second part in the series describes the composition, functioning and main role of the European Parliament. Parliamentary Committees which are responsible for developing the Parliament's votes on legislation and which may be of interest to intensive care professionals are also listed together with the contact details and chair persons. Richard Corbett describes the role of a Member of Parliament and finally the process of lobbying is explained. The final two parts in this series, for spring and summer 2005, will cover the Council of European Union and the Court of Justice.

European Parliament – the voice of European citizens

Table 1. MEP distribution across the four major European political groups

Political groups	Abbreviation	Number seats
European People's Party (Christian Democrats) and European Democrats	EPP-ED	268
Socialist Group	PES	201
Alliance of Liberals and Democrats for Europe	ALDE	88
Greens/European Free Alliance	Greens/EFA	42

Overview

The European Parliament (EP) represents the interests of the people of the European Union Member States. The President directs all activities of the Parliament and acts as its representative. Since 1979 its members, (MEPs), have been directly elected every five years by the people they represent. MEPs hence represent their constituents at a European level. The present parliament, elected in June 2004, has 732 members from all 25 EU countries. However, if the European Union's Constitutional Treaty comes into force in the future, its provisions will cap the size of the European Parliament. Rather than working in national divisions, the members sit in seven Europe-wide political groups; distribution of members across the four largest of these are shown in table 1. The distribution of members across countries is shown in table 2.

The EP has three places of work: Brussels (Belgium), Luxembourg and Strasbourg (France). Whilst Luxembourg is the home of the administrative offices (the 'General Secretariat'), meetings of the whole Parliament, known as 'plenary sessions', take place in Strasbourg for one week each month and two day meetings are sometimes held in Brussels.

Committee meetings are also held in Brussels. Similar to the US Congress, Parliament does most of its work in specialist committees. Parliament has 20 committees, each covering a particular area of EU activity (for committees of interest to intensive care, please see below). During the committee meetings, MEPs prepare for the plenary session. At the plenary sessions, Parliament examines proposed legislation and votes on amendments before coming to a decision on the text as a whole.

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The EP´s main role

The Parliament's main task is to debate and vote on European legislation, just as a national Parliament votes on national legislation.

EU legislation is normally adopted jointly by the European Parliament and the Council. Both Parliament and Council may hold two readings of draft legislation and if, by then, they have not agreed on the same text, a conciliation committee composed of 15 representatives from each side negotiates a compromise, which must then be approved by Parliament and Council. This procedure ensures that European legislation is acceptable both to the representatives of national governments (on the Council) and to MEPs whom the electorate has directly chosen to represent them.

In some fields (for example agriculture, economic policy, visas and immigration), the Council alone legislates, but it has to consult with Parliament. In addition, Parliament's assent is required for certain important decisions, such as allowing new countries to join the EU.

Parliament also provides impetus for new legislation by examining the Commission's annual work programme, considering what new laws would be appropriate and asking the Commission to put forward proposals.

How does the legislative process work?

A Member of the European Parliament, a so-called "rapporteur" working in one of the parliamentary committees, draws up a report on a proposal for a legislative text presented by the European Commission. The parliamentary committee votes on this report and may amend it. When the text has been revised and adopted in plenary, Parliament has approved and adopted the position outlined in the legislation. This process is repeated one or more times, depending on the type of procedure and whether or not agreement is reached with the Council through the co-decision procedure.

The co-decision procedure

Co-decision gives the same weight to the European Parliament and the Council of the European Union over a wide range of areas; two thirds of European laws are adopted jointly by the European Parliament and the Council. The co-decision procedure was introduced by the Maastricht Treaty on European Union in 1992, and extended and made more effective by the Amsterdam Treaty in 1999.

LEGISLATIVE PROPOSAL - The Commission presents a legislative proposal to Parliament and the Council simultaneously.

PARLIAMENT'S FIRST READING - Parliament approves amendments and submits them to the Council.

COUNCIL'S FIRST READING - If the Council agrees with the outcome of Parliament's first reading: the legislative text is adopted. If the Council does not accept Parliament's first reading vote, it draws up a common position.

PARLIAMENT'S SECOND READING - Parliament may approve the common position in a second reading or take no decision, and the legislative text is adopted in the form of the common position. Alternatively, Parliament may table amendments to the common position. In this case: either the Council approves Parliament's amendments, and the legislative text is adopted, or the Council rejects them, and a Conciliation Committee is convened to seek to reconcile the positions. If the Conciliation Committee (with members from both the Parliament and the Council) cannot agree on a 'joint text', or if Parliament or the Council does not approve it, the act is not adopted.

In what way does the EP add value to the EU?

A significant contribution of the EP is in the diffusion of potential national conflicts. Whereas the Council may appear to be concluding decisions following debate between those representing "national interests", the Parliament operates in a different way. The fact that the Parliament organises itself in political groups rather than national delegations means that disagreements on most concrete subjects are between political viewpoints or sector interests, rather than between nations.

The European Parliament moreover is part of what makes the EU radically different from a traditional intergovernmental organisation. Indeed, imagine the EU without the Parliament: it would be a system totally dominated by bureaucrats and diplomats, loosely supervised by ministers flying periodically into Brussels. The existence of a body of full-time representatives at the heart of decision-making in Brussels, asking questions, knocking on doors, shining the spotlight on dark corners, dialoguing with constituents back home, makes the EU system more open, transparent and democratic than would otherwise be the case. MEPs are drawn from governing parties and opposition parties and represent not just capital cities, but the regions in their full diversity. In short: "The Parliament brings pluralism into play and brings added value to the scrutiny of EU legislation" (Richard Corbett, MEP, 2005).

Parliamentary committees relevant to IC

The European Parliament has 20 parliamentary committees, each consisting of between 25 and 78 MEPs. These committees are presided by a chair and have a bureau and secretariat. The political make-up of the committees reflects that of the plenary assembly. The committees meet once or twice a month in Brussels and debates are held in public. The committees draw up, amend and adopt legislative proposals and own-initiative reports. Below is a list of committees working on relevant issues for ICU Managers.

Table 2. Distribution of MEPs by country (n = 732)

Austria	18
Belgium	24
Cyprus	6
Czech Republic	24
Denmark	14
Estonia	6
Finland	14
France	78
Germany	99
Greece	24
Hungary	24
Ireland	13
Italy	78
Latvia	9
Lithuania	13
Luxembourg	6
Malta	5
Netherlands	27
Poland	54
Portugal	24
Slovakia	14
Slovenia	7
Spain	54
Sweden	19
UK	78

European Institutions series

European Commission, summer 2005

European Parliament

Council of European Union, spring 2006

The Court of Justice, summer 2006

Jan Andersson, EMPL

Karl-Heinz Florenz, ENVI

Philip Whitehead, IMCO

Giles Chichester, ITRE

Photos European Parliament

Committee for Employment and Social Affairs (EMPL)

www.europarl.eu.int/committees/empl_home.htm
Chairman: Jan Andersson, Sweden, PES
jandersson@europarl.eu.int

The committee is responsible for:

- employment policy and all aspects of social policy such as working conditions, social security and social protection;
- health and safety measures in the work place;
- the European Social Fund;
- vocational training policy, including pro fessional qualifications;
- the free movement of workers and pensioners;
- social dialogue;
- all forms of discrimination at the work place and in the labour market except those based on gender.

Committee for Environment, Public Health and Food Safety (ENVI)

www.europarl.eu.int/comparl/envi/default_en.htm
Chairman: Karl-Heinz Florenz, Germany, EPP-ED
kflorenz@europarl.eu.int

The committee is responsible for:

- environmental policy and environmental protection measures, in particular concerning air, soil and water pollution, waste management and recycling, dangerous substances and preparations, noise levels, climate change, protection of biodiversity;
- public health, in particular: (a) programmes and specific actions in the field of public health; (b) pharmaceutical and cosmetic products; (c) health aspects of bioterrorism; (d) the European Agency for the Evaluation of Medicinal Products and the European Centre for Disease Prevention and Control;
- food safety issues, in particular the labelling and safety of food products.

See also under Karl-Heinz Florenz on page 48

Committee for the Internal Market and Consumer Protection (IMCO)

www.europarl.eu.int/comparl/imco/default_en.htm
Chairman: Philip Whitehead, United Kingdom, PES
phillip@phillipwhiteheadmep.net

The committee is responsible for:

- coordination at Community level of national legislation in the sphere of the internal market and customs, in particular: (a) the free movement of goods including the harmonisation of technical standards; (b) the right of establishment; (c) the freedom to provide services except in the financial and postal sectors;
- measures aiming to identify and remove potential obstacles to the functioning of the internal market;
- the promotion and protection of the economic interests of consumers, except for public health and food safety issues, in the context of the establishment of the internal market.

Committee for Industry, Research and Energy (ITRE)

www.europarl.eu.int/committees/itre_home.htm
Chairman: Giles Chichester, United Kingdom, EPP-ED
gchichester@europarl.eu.int

The committee is responsible for:

- the Union's industrial policy and the application of new technologies;
- the Union's research policy, including the dissemination and exploitation of research findings;
- the information society and information technology, including the establishment and development of trans-European networks in the telecommunications sector.

Other possibilities for contacting the EP

You can also contact the European Parliament through its Correspondence with Citizens Unit, which will provide an answer to your questions: www.europarl.eu.int/registre/portail/CourrierCitoyen.cfm?langue=EN Moreover, any resident of the European Union, whether or not a citizen of a Member State, may, individually or in association with others, submit a petition to the European Parliament on a subject which comes within the European Union's fields of activity, and which affects them directly. Any company, organisation or association with its headquarters in the European Union may also exercise this right of petition.
Finally and also of interest regarding individuals' rights, Article 255 of the Treaty establishing the European Community states that citizens and residents of the European Union have a right of access to European Parliament, Council and Commission documents.

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Lobbying MEPs

Helicia Herman and Sonja Planitzer explain what an MEP can do for you, how to reach the right person, how to prepare for lobbying, and present advice from MEP Karl-Heinz Florenz.

Lobbying your MEPs

Currently there are about 15,000 lobbyists in Brussels (consultants, lawyers, trade associations, corporations, NGOs) seeking to influence Commission officials and MEPs in their decision making process. Officially, MEPs attend to their own government policies, the political grouping they belong to in the European Parliament (EP), their constituents and lobby groups in Brussels.

You can lobby an MEP to:

- Vote in a certain way on legislation
- Represent an opinion in committee discussions on new laws, and
- Put you in touch with other MEPs interested in your campaign

Your MEPs also have a responsibility to help you understand European laws and advise you on their impact.

Tips for lobbying

TARGETING THE RIGHT MEP - A full list of MEPs is available at: www.europarl.eu.int/members/public.do?language=en. To target and prioritize who to lobby, you need to research MEPs' interests:

- Which Parliament Committee do they belong to? (Prioritise members over substitutes). See: www.europarl.eu.int/activities/expert/committees.?language=en
- Do they chair or vice chair their European political group? See:www.europarl.eu.int/members/expert.do? language=EN
- Are they the spokesperson for their home party in the EP? Visit the EP website or MEP websites. MEPs either have their own sites, or home party sites. Search on www.google.com for each MEP by name.
- Which constituency does the MEP represent? Having a local connection with an MEP gives you the advantage of knowing what the MEP's interests are.

CONTACTING THE MEP - Enquiries are dealt with in Brussels or in the home country of the MEP, so you can contact an MEP at either office. Some MEPs have a preference, however, so phoning the home office to ask an MEP's assistant how best to proceed may help. The kind of contact MEPs are most likely to respond to is a personal letter or e-mail. This needs to be signed, (or contain the constituent name and address), be easy to read, and explain in a few sentences your reasons for contacting the MEP and what your main arguments on the issue are.

MEETING THE MEP - MEPs spend some time in Brussels, Strasbourg and their constituency office, so you can arrange to meet them in Belgium, France or their home country. The meeting should be well prepared for: it is important to express your concerns clearly. Prepare a short speech of approximately 10 minutes, and write your arguments in a position paper to leave with the MEP. If you see the MEP together with other people, make sure your position is clear and that no contradictions confuse the issue.

TARGETING THE RAPPORTEUR - If your local MEP is not involved in the issue of your concern, you need to contact the "rapporteur", (designated MEP), who is in charge of preparing the committee´s report on the relevant legislative proposal. Find an MEP who is on the committee you are interested in and ring them to ask who the rapporteur is. If you don't speak a common language with the rapporteur, lobbying will be more difficult and you may need to contact your home country MEP on the Committee, and work through them. Once you know who the rapporteur is, a letter campaign directed at them, whatever their native language, still highlights the issue.

FOLLOW-UP - Once you have sent a letter or e-mail, you need to follow up by phoning the MEP some time later, to reemphasise your points.

MEP viewpoint: Karl-Heinz Florenz

MEP Karl-Heinz Florenz, Christian Democrat and Chairman of the Committee on the Environment, Public Health and Food Safety, comments on lobbying in the EP.

"For the lobbying industry in general, a code of behaviour would be a good idea. There are so many different groups of lobbyists, for associations, regions, NGOs etc. But, of course – like anywhere – there are good ones and bad ones. It is definitely an advantage to MEPs having so many lobbyists in Brussels. We can't know everything, so a good lobbyist can provide us with thorough input and background knowledge on certain problems and subjects. The only question is the quality. A good lobbyist has targeted information, gives practical solutions, doesn't waste time, makes timely interventions, provides balanced views, and reacts to requests. It's very important that the lobbyist can make a focused and objective presentation."

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An MEP´s **job**

Richard Corbett describes the role of an MEP, and in particular how this compares to the role of an MP. He is spokesperson for the Party of European Socialists on the European Parliament's Constitutional Affairs Committee, and is also a substitute member on the Citizens' Rights, Justice & Home Affairs Committee. He has authored several books on Europe, including "The European Parliament", "A Socialist Policy for Europe","The Treaty of Maastricht" and "Labour and 1996".

Members of the European Parliament are elected to deal with European issues.
MEPs represent regional constituencies and elections are by proportional representation, with each party offering a team of candidates.
An MEP's main task is to vote on European legislation, just as MPs vote on national legislation. However, MPs in many national parliaments do not shape legislation in the same way as MEPs. In some national parliaments, when a government publishes a bill, it is usually clear what will come out of the procedure – it is headline news if the parliament amends it against the will of the government. Some even claim that certain national parliaments are little more than rubber-stamps for their government's legislation.

This is certainly not the case in the European Parliament. A draft directive really is a draft – MEPs go through it paragraph by paragraph, amending it and rewriting it. So do the ministers in the Council, and ultimately the positions of the two must be reconciled in what (since the Amsterdam Treaty) amounts to a bicameral legislature at EU level. But the net effect is that every year, thousands of amendments to draft legislation put forward by ordinary back-bench MEPs end up on the statute books and apply in 25 different countries.

In national parliaments, being a backbencher, or an opposition party MP often offers very limited power and little job satisfaction other than the prospect of, perhaps, one day wielding ministerial power.

MEPs, on the other hand, while not having a career path to a ministry (though a surprising number do become ministers in their member states) can play a significant role in shaping legislation – a classical parliamentary function almost forgotten by some national parliaments.

Your MEP is your voice in Brussels

The nature of day-to-day work is also different. One measure of a good MP in a national context is someone who is a good debater, able to score points over his or her opponents. An effective MEP is someone who is good at explaining, persuading and negotiating with colleagues from 25 different countries. This is done at three levels:

- Within political groups, as MEPs from different national parties work towards developing a common position as a group;
- With other groups in the Parliament, as no group has an overall majority and coalitions must be built. Indeed, the type of majority can vary from one issue to another as there is no predetermined coalition, but a general willingness to work by means of achieving substantial majorities on most issues;
- Once Parliament has a position, there is a need to negotiate with Council for the final outcome.

Such a style of Parliament leaves ample scope for an active MEP, providing that he/she is good at building the necessary majorities.

Photo European Parliament

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Imposing stricter controls on lobbying

In March 2005, Commissioner Siim Kallas proposed the launch of a European Transparency Initiative announcing plans to strengthen transparency rules for EU policy-makers, including regulations for lobbyists seeking to influence them in Brussels. Organisations, groups or persons in the ambit of European institutions which offer advice, represent clients, provide data or defend public causes should also be accountable, says Kallas.
Currently, there is no mandatory regulation on reporting or registering lobby activities. Registers provided by lobbyists' organisations in the EU are voluntary and incomprehensive and do not provide much information on the specific interests represented or how activities are financed. Here there is room for improvement. The same applies to Non Governmental Organisations, many of whom rely on public funding, some from the Commission. Therefore the current registry of NGO's should be improved and contain financial information.

Website
http://europa.eu.int/comm/commission_barroso/kallas/transparency_en.htm

Healthcare system in **England**

Dr Kim Sutherland, co-author of "The Quest for Quality in the NHS: a chartbook on quality of care in the UK" (2005), describes the infrastructure of the NHS in England.

Table 1. The core principles of the NHS (DH, The NHS Plan 2000: 3-5)

1.	The NHS will provide a universal service for all based on clinical need, not ability to pay.
2.	The NHS will provide a comprehensive range of services
3.	The NHS will shape its services around the needs and preferences of individual patients, their families and their carers
4.	The NHS will respond to different needs of different populations
5.	The NHS will work continuously to improve quality services and to minimise errors
6.	The NHS will support and value its staff
7.	Public funds for healthcare will be devoted solely to NHS patients
8.	The NHS will work together with others to ensure a seamless service for patients
9.	The NHS will help keep people healthy and work to reduce health inequalities
10.	The NHS will respect the confidentiality of individual patients and provide open access to information about services, treatment and performance.

The National Health Service (NHS) was established in 1948 and since that time has played a central role in British life, providing a broadly comprehensive service that is based on clinical need rather than ability to pay. The NHS serves over 50 million people in England and in the financial year 2004-5, its total net expenditure was £69bn. Although the healthcare sector in the UK is dominated by the NHS, there is substantial private provision. OECD figures for 2002 show that the £67bn public expenditure on healthcare was supplemented by £13bn of private expenditure (OECD Health Data, 2005).

Each day there are:

- 836 000 consultations with general practitioners or nurses in primary care
- 124 000 outpatient attendances
- 36 000 patients in bed as elective admissions
- 94 000 patients in bed as emergency admissions
- 49 000 Accident and Emergency (A&E) attendances
- 18 000 calls to NHS Direct (telephone advice service)

(Chief Executive's Report to the NHS, May 2005)

The NHS is mainly financed through taxation and has to account for its actions to Parliament via the Secretary of State for Health. The Secretary of State is a member of cabinet and has overall strategic responsibility for NHS delivery, improvement, finance and resources. The Department of Health (DH) supports the Government in improving the health and well-being of the population. It negotiates levels of funding with the Treasury, and allocates resources throughout the health service.

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Structurally, the main features of the NHS in England are:

- 28 Strategic Health Authorities (SHAs) which manage the NHS locally on behalf of the DH. Each covers approximately 1.8 million people. Their key functions are:
  - To create a strategic framework for capital investment, information management and workforce development;
  - To agree and monitor performance levels in primary and secondary care;
  - Build capacity and support performance improvement.
- 295 NHS Trusts, comprising 176 acute trusts (which provide medical and surgical care, usually centred on a hospital); 88 mental health trusts; and 31 ambulance trusts. Foundation trusts are a recent development that are designed to give greater freedom to NHS organisations (e.g. can retain operating surpluses; access to capital markets) whilst at the same time subjecting them to standards, performance ratings and inspections systems used throughout the sector. There are currently 31 foundation trusts, with 32 (including eight mental health trusts) applying for 2006.
- 302 Primary Care Trusts (PCTs) which run primary and community services and commission care from a wide range of NHS and other providers. PCTs each serve around 170 000 people and control around 75% of the NHS budget.

The English public are deeply committed to the NHS and that commitment, together with the level of public expenditure that healthcare consumes, means that health policy is a subject of significant attention both inside and outside Government. The core principles that underpin the NHS were articulated by the Government in 2000 (see table 1).

Building on these principles, the Blair Labour Government has developed and implemented a plethora of policy initiatives, along a number of themes. These include:

- Improving the quality of healthcare.
- Providing greater patient choice.
- Plurality of provision in healthcare services.

UK intensive care

Drs Ridley and Winter present the facts on intensive care in the UK.

Bearing in mind the problems with the definition of an intensive care unit and the existence of single specialty units, there are about 285 adult general intensive care units in the UK. These units serve a total population of 60 million. The latest figures from the UK Department of Health show that there were 3193 critical care beds in September 2005 (www.doh.gov.uk). These are divided between 1772 Level 3 (ICU) beds and 1422 Level 2 (HDU) beds. This provides a national distribution of one ICU bed per 34,000 population and one HDU bed per 42,000. However, there is wide geographical variation, with the distribution of ICU beds varying between 3 and 8 per 100,000 with fewer critical care resources in rural areas compared to large cities.

In 1998, the Audit Commission reported that the median size of an ICU in the UK was 5.3 beds. Since 2000, following additional government funding, the total number of critical care beds has increased to an average 11 ICU and/or HDU beds per unit.

The number of nursing staff on intensive care is one nurse per critically ill patient. This requires an establishment of between six to seven whole time equivalents per ICU bed (7.3 if UK statuary leave is accounted for). On the HDU, the nursing establishment is less with one nurse per two patients, as the perceived level of intervention is less on HDU. The size of the medical team on call during the day and night varies, but one medical team (i.e. one senior doctor plus a trainee) should be able to look after eight ICU patients. This level of staffing has been accepted and recommended by the Department of Health (2000). The importance of increasing the establishment of other healthcare professionals contributing to the care of the critically ill has just recently been formally recognised in the report of the Adult Critical Care Stakeholder forum, "Quality Critical Care: Beyond Comprehensive Critical Care" (2005: see page 54 for more information on this report).

Figures from the Intensive Care National Audit and Research Centre (ICNARC) suggest that the average age of patients admitted to critical care units in 2002 to 2003 was 60.1 years and most patients were admitted from the operating theatres (42%), the general ward (23%) or emergency departments (18%) (ICNARC 2004a). The commonest three reasons for admission were pneumonia (7.6%), aortic or iliac dissection or aneurysm (4.4%) and large bowel tumour (4.2%). In the UK, the mean APACHE score is 16.5 (ICNARC 2004b) and the ICU mortality approximately 20% with a further 9% of patients dying before leaving hospital (ICNARC 2004a).

> While there are reports of beneficial improvements in the level of understanding of critical illness on the general ward, the hoped for reduction in mortality has not been reported

The cost of UK critical care is difficult to establish as a percentage of a hospital budget, but results from the National Cost Block Study (Medical Economics and Research Centre Sheffield 2005) suggest that in 2002-2003 the average daily cost of ICU was £1186, while combined ICU/HDU cost £1063 per day. Most UK ICUs run as closed units but the clinical and management responsibility for HDU patients is more likely to be shared on an open basis.

Although outreach services have been well developed and supported in the UK, with a variety of models, their full impact has been difficult to prove. While there are reports of beneficial improvements in the level of understanding of critical illness on the general ward (Ball et al. 2003), the hoped for reduction in mortality has not been reported (Hillman et al. 2005).

Clinical critical care research in the UK was until recently institution based. However, the UK Intensive Care Society (www.ics.ac.uk) has appointed a Director of Research and an Intensive Care Foundation to organise critical care research on a trials network as presently occurs in Canada, Australia and New Zealand. The first trial is examining the advantages (or otherwise) of early versus late tracheostomy.

In the UK, the education and training of doctors is undertaken by the Intercollegiate Board for Training in Intensive Care Medicine. The Board stipulates the competencies that trainees need to acquire and sets the standard for ICUs to be recognised as training centres. The Board also runs the UK diploma in intensive care medicine.

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ICNARC – promoting improvements

Kathryn Rowan describes the goals of the Intensive Care National Audit & Research Centre (ICNARC).

Table 1. ICNARC research programme - examples

Research areas	Published work	Researchers
Evaluation of health technologies	Patient management with a pulmonary artery catheter	Harvey et al. 2005
	Activated protein C	Padkin et al. 2001
Evaluation of determinants of outcome	Volume	Jones and Rowan 1995
	Gender	Raine et al. 2002
	Socioeconomic status	Hutchings et al. 2004
	Winter	Harrison et al. 2004
Evaluation of service delivery and organization	End of life decisions	Wunsch et al. 2005
	Night discharge	Goldfrad and Rowan 2000
	Day/time of admission	Wunsch et al. 2004
Epidemiology of diseases	Severe sepsis	Padkin et al. 2003
	Acute severe asthma	Gupta et al. 2004
International comparisons of critical care	Europe/USA	Vasquez Mata et al. 1996
	Colombia	Dennis et al. 2000, 2002; Perez et al. 2005

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ICNARC is an independent, charitable company. Established in 1994, through an initial two-year grant from the UK government, it is now self-financing.

The Intensive Care National Audit & Research Centre (ICNARC) was established in response to a proposal to the UK government, following the UK APACHE II Study (Rowan et al.1993a&b, 1994). Aiming to improve organization and practice of critical care (both intensive and high dependency) in England, Wales and Northern Ireland, ICNARC has five main goals, which are described here.

Promoting performance improvement - The Case Mix Programme is a performance assessment programme, promoting continued improvement through the provision of routine feedback of comparative data on case mix, outcomes and activity, to facilitate local performance management. A specimen report can be found at www.icnarc.org. Specified data are collected by trained data collectors from participating units and are extensively validated, both locally and centrally, before analysis and feedback (Rowan and Black 2000). The resultant Case Mix Programme Database has been independently rated as a high quality clinical database (www.docdat.org). The database is used for routine feedback to units and also for secondary research studies (see below). Participation in the Case Mix Programme is voluntary and, with over 70% of adult, general (mixed medical/surgical) units participating, it runs on a cost-recovery basis with units paying a small annual contribution.

Promoting research - ICNARC used consensus development methods to elicit direct input from staff in critical care units to develop and prioritise its national programme (see table 1) for research in critical care (Goldfrad et al. 2000; Vella et al. 2000). The large numbers of critical care units - both contributing data to the Case Mix Programme Database and collaborating, following invitation, in research studies - afford a large, representative sample to provide unbiased, scientific research evidence to influence health services policy at all levels (Harrison et al. 2004). The ongoing research programme includes studies evaluating critical care outreach services, teamwork and safety attitudes among critical care staff, patients' experiences of critical care and international comparisons.

Promoting quality in audit and research - ICNARC works to improve the quality of both audit and research predominantly through a programme of methodological research aimed at improving:

- risk prediction modelling (Harrison et al. 2005; Wunsch et al. 2004)
- diagnostic coding (De Keizer et al. 2000; Young et al. 2001)
- the validity and reliability of data (Rowan 1996), and
- the interpretation of analyses (Ridley and Rowan 1997, Rowan and Angus 2000).

ICNARC encourages user involvement in all aspects of the conduct and output from its audit and research, and encourages scientific rigour through education (Wunsch et al. 2005).

Promoting evidence-based practice - ICNARC has actively contributed to the work of the Cochrane Collaboration in ensuring that all the relevant, rigorous, research evidence was identifiable and available, by co-ordinating the hand-searching of the emergency medicine and critical care literature for randomized controlled trials (Langham et al. 1999, Langham et al. 2002). ICNARC has also contributed to the growing body of reviews of the evidence on outcomes (Black et al. 2001), organizational factors (Carmel et al. 2001) and interventions (Grocott et al. 2004; Harvey et al. 2004; Langham et al. 2003). In addition, ICNARC staff and/or data contribute to both practice and policy discussions at all levels from local to national (Rowan et al. 2004).

Promoting research capacity - A number of critical care researchers, both nationally and internationally, collaborate with ICNARC often as part of Masters or Doctorate degrees. In addition, ICNARC encourages its own research staff to gain research training and contributes towards fees.

National IC databases series
NICE in the Netherlands, autumn 2005
ICNARC in the UK
ANZICS databases, Australia, spring 2006

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Adult Critical Care **Stakeholder Forum**

Dr Peter Royle explains the activities of the Adult Critical Care Stakeholder Forum in the UK, and its most recent project "Quality Critical Care: Beyond Comprehensive Critical Care".

Forum

The Adult Critical Care Stakeholder Forum (CCSF) was established in April 2004 to mobilise stakeholder involvement in the strategic development and delivery of critical care services and to provide a communications link between a wide variety of professional, operational and managerial groups delivering critical care. It evolved from the National Expert Group that produced the policy document 'Comprehensive Critical Care (Department of Health May 2000), which guided the NHS Modernisation Critical Care Programme that ended in September 2004. The Forum is not led by the Department of Health, but the Department is a stakeholder alongside others. The Forum has stakeholder representation from patient and carer groups, critical care nursing organisations, critical care networks, scientific and educational organisations, medical organisations (including the Intensive Care Society and some Royal Colleges), the Independent Sector and NHS managerial organisations.

The Forum meets formally four times per year, but much additional work is done between meetings by email and smaller meetings of stakeholders working on specific projects. The Forum discusses national healthcare developments and issues that affect critical care, and transmits the views of the Forum to relevant parties e.g. the Forum recently wrote to the Secretary of State for Health expressing its views on the recent NCEPOD report on medical admissions to critical care.

Quality critical care

For the last year the Forum has been preparing a national guidance document that gives advice on providing a quality critical care service. The document is entitled "Quality Critical Care: Beyond Comprehensive Critical Care" and was launched in September 2005. The document has been available on the websites of the Intensive Care Society, the Royal College of Nursing and the British Association of Critical Care Nursing since mid October. There will also be 1000 paper copies of the document distributed to relevant agencies such as critical care networks, strategic health authorities and to the CCSF members for dissemination into their organisations.

In the document, the Forum outlines the structures and components that it feels should be in place to allow delivery of a critical care service that meets patients' needs. The document builds on the work already done following the introduction of Comprehensive Critical Care in 2000. The document supports the critical care network structure, critical care delivery groups and the further development of level 1 care in general ward areas. Various other issues, including critical care capacity and the provision of post-intensive care rehabilitation are discussed. The document will be particularly useful for critical care networks to use in their negotiations with commissioners and critical care providers to develop a consistent high quality critical care service.

'I commend (the report) to all commissioners, managers and clinicians involved in delivering and developing this essential service.'

Sir George Alberti, Medical Director of Emergency Care quoted from the report's foreword

Future activities

The Forum will continue to discuss critical care issues and will be tackling subjects such as the introduction of payment by results, capacity planning, new roles, education and training, integration of critical care services with acute medicine and new data and audit systems.

Contacts and further information

The views of critical care clinicians can be expressed to the Forum via representatives on critical care delivery groups, local critical care networks, professional organisations such as the ICS or the Royal College of Anaesthetists, or by directly contacting the Chair (peter.royle@nth.nhs.uk).

The document, "Quality Critical Care: Beyond Comprehensive Critical Care", can be viewed on the following websites:
Department of Health www.dh.gov.uk
The Intensive Care Society www.ics.ac.uk

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With long-lasting Hibisol, the case for alcohol-only handrubs gets weaker by the second

The bactericidal activity of some alcohol-only gels has been shown to last for just two minutes after application¹. So after only two minutes every time you wash something, you're at risk of transmitting infectious organisms unless you remember to reapply the alcohol. On a busy ward it is just not feasible to apply a handrub every two minutes.

That's why Hibisol is becoming the new watchword on wards. Its active ingredient chlorhexidine is clinically proven to remain effective for up to 6 hours² – that's the case for using alcohol-only gels gets weaker by the second. Hibisol offers a combination of the rapid kill and convenience of an alcohol gel, plus the long-lasting activity of chlorhexidine.

Long-lasting Hibisol. Safer wards start with safer hands.

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1. Pratt RJ, Pellowe CM, Wilson JA, Loveday HP, Harper PJ, Jones SR, McDougall C, Wilcox MH. epic2: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. J Hosp Infect. 2007 Jun;65 Suppl 1:1-64.

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MRSA status and strategies in the UK

This article outlines the current UK strategy for combating MRSA at a national and local level.

Table 1. Major UK government infection control documents / campaigns & websites

Dec 03	Winning Ways: Working together to reduce Healthcare Associated Infection in England. www.dh.gov.uk/assetRoot/04/06/46/89/04064689.pdf
July 04	Towards Cleaner Hospitals and Lower Rates of Infection www.dh.gov.uk/assetRoot/04/08/58/61/04085861.pdf
July 04	Standards for Better Health www.dh.gov.uk/assetRoot/04/08/66/66/04086666.pdf
Started 04	Rapid Review Panel – to review novel methods and products that claim benefit in respect of reducing healthcare associated infection www.hpa.org.uk/infections/topics_az/rapid_review/default.htm
Started 04	'Cleanyourhands' campaign – Ongoing campaign to encourage widespread use of alcohol based hand hygiene products www.npsa.nhs.uk/cleanyourhands
July 05	Saving Lives – A Delivery Programme to Reduce Healthcare Associated Infection including MRSA www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCareTopics/HealthcareAcquiredInfection/HealthcareAcquiredGeneralInformation/SavingLivesDeliveryProgramme/fs/en

hospitals have been set a target for reducing the number of episodes of MRSA bacteraemia by 50% by March 2008

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The prevalence of Methicillin Resistant Staphylococcus Aureus (MRSA) colonisation and infection within the UK is amongst the highest in Europe (www.earss.rivm. nl). To obtain a meaningful picture of the situation across the UK, the Government made reporting of all MRSA positive blood cultures mandatory from April 2001. Since then rates per 1000 acute bed-days have been published annually for each hospital trust. This data is a reasonable surrogate for all MRSA infections within a healthcare establishment. This scheme has revealed widely varying rates across the country, but rates are generally highest in the south, particularly in London. Not surprisingly, teaching hospitals have higher rates than general hospitals. Details of actual rates and a summary report of the first four years of this scheme are available on line.

www.dh.gov.uk/ assetRoot/04/11/40/15/04114015.pdf and www.hpa.org.uk/infections/topics_az/staphylo/MRSA_four_year.pdf

Despite this data being in the public domain and pressure from the Department of Health (DH), the overall rate has not changed significantly over the past four years, although a number of individual hospitals have improved. This is not surprising as control of MRSA is inextricably linked to control of infection generally and this has remained a low priority compared to waiting list and financial targets. However, this situation is beginning to change. Pressure from the media, patients, relatives and the wider public has resulted in infection control being seen as an increasingly important issue. The advent of 'patient choice' and the 'Freedom of Information Act' has increased this pressure further.

The UK DH has produced a number of documents and campaigns reiterating its commitment to reducing MRSA and healthcare associated infection in general and advising hospitals on the actions they should take. The major documents/campaigns are listed in table 1. Each document has a slightly different emphasis, but many threads in common; the recurring themes are listed in table 2. Some of these documents are mere policy statements, whilst others lay out more specific goals. The current major operational document is the 'Saving Lives' programme. This is based on the action-bundle approach whereby a number of actions need to be introduced simultaneously rather than a

Table 2. Common themes within UK strategy documents

- Commitment of high-level managers
- Ownership at ward/department level
- Hand hygiene
- Clean environment
- Decontamination of equipment
- Education for staff, patients and relatives
- Surveillance of infection rates
- Audit of compliance with infection control protocols
- High impact interventions
  - Preventing the risk of microbial contamination (hand hygiene, personal protective equipment, aseptic technique and disposal of sharps)
  - Central venous catheter care
  - Preventing surgical site infection
  - Care of ventilated patients
  - Urinary catheter care

piecemeal approach. The Programme contains a self-assessment and action-planning tool, which generates a balanced scorecard.

In addition to self-assessment, external assessors are to continue to address infection control with a more detailed focus than in the past. The two major assessors are the Healthcare Commission and the Clinical Negligence Scheme for Trusts. In relation to MRSA in particular, hospitals have been set a target for reducing the number of episodes of MRSA bacteraemia by 50% by March 2008. To attain this, hospitals have been advised to aim for a 20% reduction on the 2004-5 MRSA numbers each year for the next three years. Finally, the DH is developing a Code of Practice entitled 'Action on Health Care Associated Infection in England' to which trusts will be expected to adhere. A draft of this document was likely to be published during 2005 (www.dh.gov.uk/assetRoot/04/11/53/06/ 04115306.pdf).

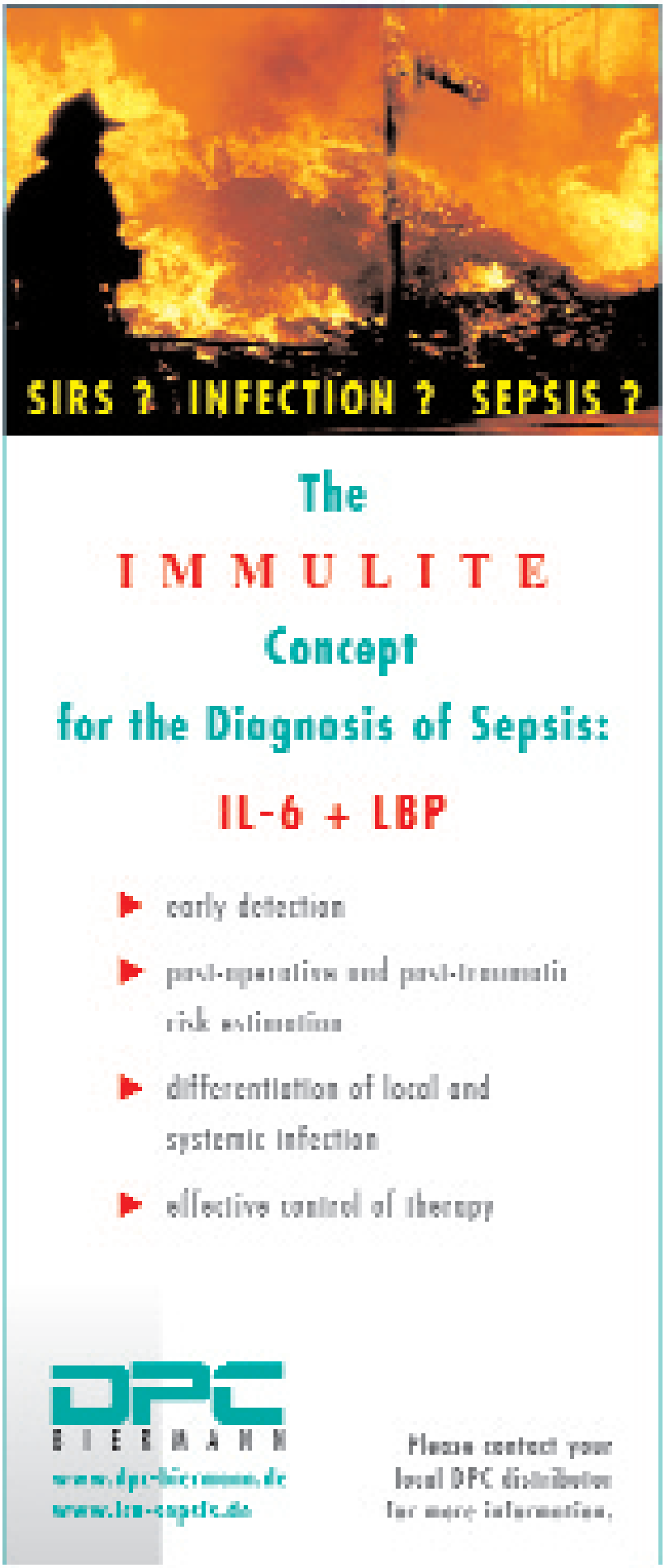
Implementing the national strategy at a local level will inevitably differ depending on the size and complexity of the hospital concerned. No extra central funding has been made available for this issue and therefore hospitals will need to find the funding from existing budgets. The main strategies under consideration are listed in table 3.

In summary, controlling MRSA has moved up the agenda both nationally and locally. However, given the current extent of MRSA colonisation and infection, the aforementioned strategies will need to be applied consistently for a number of years if significant and permanent inroads are to be made.

See also Dr G. Bellingan's viewpoint on MRSA management in intensive care practice on page 40.

Table 3. Examples of local implementation strategies

- Use existing risk-management and clinical governance networks to embed infection control into practice at all levels
- Performance managed wards/departments using infection control parameters
- Increase the amount of MRSA pre-admission and admission screening
- Develop "ring-fenced" wards where only MRSA negative patients can be treated.
- Improve MRSA de-colonisation regimens
- Implement national best practice guidelines for central intravenous line care
- Develop an infection rate surveillance programme and feed back data regularly to clinicians
- Develop an audit programme of compliance with infection control protocols



Outreach in the UK

Sarah Bateman describes the development of outreach in the UK and how her team operates.

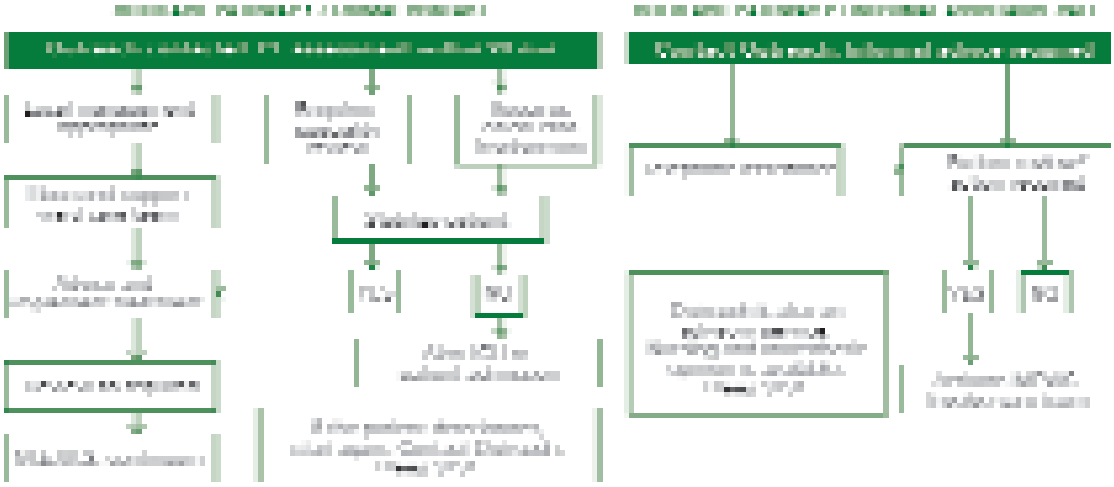


Figure 1. Adapted from 'Pathway to outreach', SUHT 2005

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Outreach in the UK

Within the United Kingdom (UK), concerns regarding sub-optimal management of the critically ill patient outside the intensive care setting were identified during the latter part of the 1990's (McGloin et al. 1997; McQuillan et al. 1998). Contributing factors included ward manpower restrictions, increased patient acuity and the lack of education and support for ward based medical and nursing staff. Following government recommendations and in response to national policy documents examining critical care services in the UK (Department of Health, HMSO 2000), a plan for reform and modernisation was proposed. This recommended a hospital-wide approach to care of the critically ill patient, for timely critical care skills to be provided for patients, irrespective of their location.

Outreach service at SUHT

In Southampton University Hospitals Trust (SUHT) UK, the impetus provided by these recommendations led to three initiatives to improve care of the critically ill patient:

- critical care education through the Acute Life-threatening Events Recognition and Treatment (ALERT; Smith 2000) course – a multi professional course in the care of the acutely ill patient,
- use of the Modified Early Warning System (MEWS) to identify the deteriorating patient, and
- the introduction of the critical care outreach service.

In response to critical care service demands, a 24-hour outreach service was established in SUHT during the year 2000. The outreach service is provided by the critical care outreach team (CCOT), which is predominantly a nurse-led service with significant consultant nurse and medical intensivist input. The main focus of the CCOT is to provide a seamless service, to avert admissions to the Intensive Care Unit (ICU), to enable ICU discharges and to share and develop critical care skills through direct care delivery, advice, guidance and support. The service was initially introduced to acute care areas in November 2000 and progressed to being fully operational across all key clinical directorates by December 2000. Since its inception, the CCOT has dealt with 7264 referrals to date.

The referral process for the outreach service can be accessed by either a formal or informal pathway (see figure 1). Within this referral process and for all subsequent interventions, the benefits of inter professional working need to be demonstrated to all clinical areas. This not only encourages collaboration within the CCOT, but also between the CCOT and ward based clinical staff and, equally as important, between medical and nursing teams in different clinical areas.

Part of the CCOT role at SUHT also includes being actively involved with education programmes for both single- and multi-professional healthcare groups to educate and share critical care skills and promote collaborative working. The Immediate Life Support (ILS)

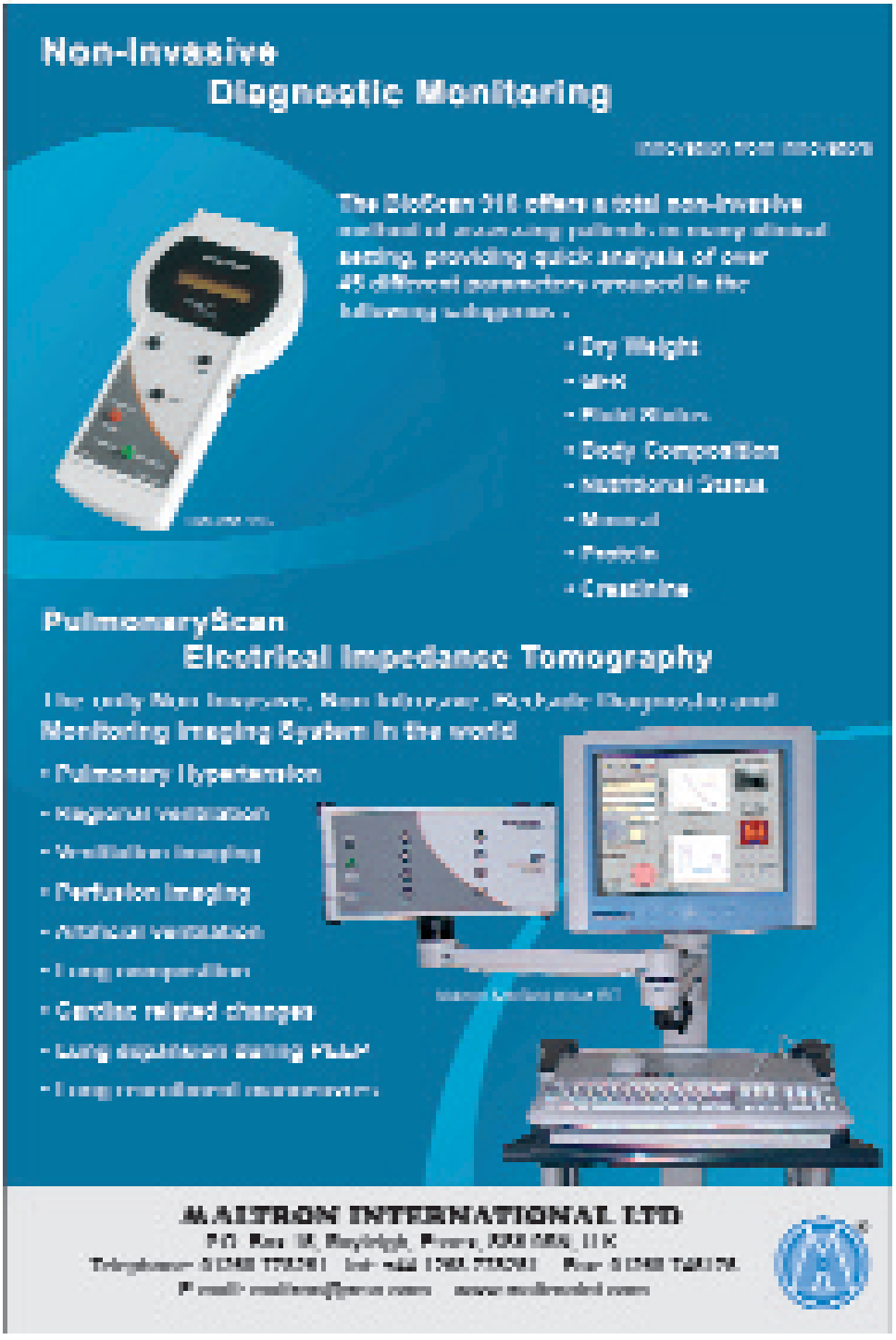
(Resuscitation Council UK 2002) and ALERT (Smith 2000) courses are both taught at SUHT to educate staff in the management of the acutely ill adult, encourage a team approach and raise awareness of inter professional roles and abilities.

Referring teams are often reluctant to accept advice from the CCOT, due partly to limited understanding of the severity of the patient's acuity and associated physiological disturbances, but also reluctance to take advice from a nurse. The CCOT therefore has a responsibility to inform, update and publicly promote the service to ensure clarification and minimise misunderstandings regarding the CCOT role. Conversely, the medical profession needs to adjust traditional views and adapt to new ways of working. This means medical professionals must be prepared to receive and accept advice from outside their clinical area of expertise and recognise that the CCOT provides a complementary, not conflicting, service to integrated care.

Way forward

The development of innovative roles as alternative models of care is essential, as public and government pressures demand a better NHS. The critical care outreach team provides one such alternative model and is being successfully utilised to develop services and improve patient care (Ball et al. 2003).

Whilst the CCOT will continue to meet the demand for critical care skills outside the intensive care setting, it is likely that the way in which this service is provided may change in response to ever changing healthcare needs. The implications associated with the European Working Time Directive (EWTD), logistical management of the higher acuity patient and the Hospital at Night programme (www.modern.nhs.uk/hospitalatnight) could well see a review of the role of the CCOT.



26th International **Symposium** of Intensive Care and Emergency Medicine

Professor Jean-Louis Vincent presents a flavour of the programme for the 26th International Symposium of Intensive Care and Emergency Medicine.

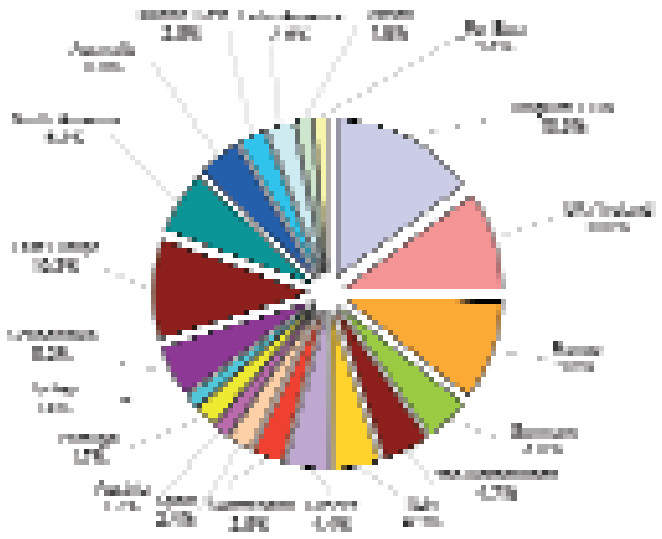


Figure 1. Participation of the 25th ISICEM (March 21-25, 2005)
Exhibitors not included, 85 countries, approximately 5000 participants

The 26th International Symposium of Intensive Care and Emergency Medicine will be held at the Congress Centre in Brussels from March 21 to March 24, 2006, and we are looking forward to another exciting week of lectures, pro-con debates, tutorials, workshops, round tables, and meet-the-expert sessions, covering all aspects of intensive care and emergency medicine.

Preparation of the preliminary program is now well advanced and there will be something for everyone with sessions on basic cellular physiology and metabolism; the latest advances in sepsis and ARDS pathophysiology and treatment; recent results with non-invasive haemodynamic monitoring systems; a new look at some old controversies, including colloids versus crystalloids, dopamine versus norepinephrine, … and much more.

Good management has an increasingly important role to play in today's intensive care unit (ICU), particularly with the high costs of new therapies and interventions, and several sessions will focus on this area. Some of these will consider how new developments in technology may influence patient care. Technology in general is developing almost unbelievably fast – it is difficult to believe that it is only 30 years ago that the first portable computer was developed (weighing 23 kg!) and the first mobile telephone call was made (there are now some 50 million mobile phone owners in the UK alone!). ICU technology is also advancing fast and impacting on various aspects of intensive care including ICU management. For example, databases and electronic informatics systems are now widely used to store individual and group patient data. Such databases can be used to improve quality of care, facilitate optimum resource allocation, and improve patient safety. Ongoing and proactive surveillance of infectious diseases, using specifically designed databases and including microbiological patterns and anti-microbial resistance can help in the development of effective infection control strategies resulting in reduced patient morbidity and mortality and, hence, reduced costs. Many units are also now considering the ICU robot as a serious possibility, after some initial scepticism. This technological advance allows doctors to "virtually" interact with patients, family members and healthcare staff from a distance and could help ensure 24-hr intensivist care, which has been shown to improve outcomes, for patients where there are doctor shortfalls.

> The ISICEM is now the largest annual meeting of its kind, attracting almost 5000 participants from around the world

The ISICEM is now the largest annual meeting of its kind, attracting almost 5000 participants from around the world and including a faculty of some 200 international experts in their field (see figure 1). In addition to providing participants with the latest pathophysiologic, diagnostic, technologic, and therapeutic advances in their field, it also offers them an opportunity to meet other doctors from other units, hospitals, states and countries. Informal "data-exchange" over a cup of coffee or during lunch can provide us with useful insight into how other doctors in other hospitals, countries, and continents live and work. The underlying hope of the ISICEM management is that each participant will take back to their ICU some new knowledge or technique to share and implement at a local level to optimize patient care.

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26th International Symposium on Intensive Care and Emergency Medicine

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the canadian critical care society
Australian and New Zealand Intensive Care Society
World Federation of Societies of Intensive and Critical Care Medicine

Deadline for abstract submission: December 15, 2005

11th International Symposium on **infections** in the critically ill patient

Professor Artigas welcomes you to Seville February 3-4, 2006 for an update from the experts on concepts, technology and advances in infections in the critically ill patient.

Organized by:
Antonio Artigas
Jean Carlet
Michael Niederman.

Supported by:
- European Society of Clinical Microbiology & Infectious Diseases
- Sociedad Española de Enfermedades Infecciosas y Microbiologia Clínica
- Sociedad Española de Medicina Intensiva y Unidades Coronarias
- Sociedad Española de Neumología y Cirugia Torácica

Endorsed by:
- European Respiratory Society
- European Society of Intensive Care Medicine
- Society of Critical Care Medicine

The International Symposium on Infections in the Critically Ill Patient was created to review the current concepts, technology and advances in infections in the critically ill patient. Sepsis, Basic Research and Epidemiology, Pulmonary Infections and Prophylaxis, and Treatment of severe infections are the topics of the main sessions presented by international experts, who review and update the new advances on infections in critically ill patients. Each session has an update and year review of the most important scientific contributions to each specific topic. At the end of each session a clinical controversy or other relevant topic is debated.

The target audience of this successful annual Symposium are physicians who care for individuals with severe infections in the ICU, and scientists interested in the basic mechanisms related to host response and infections of severely critically ill patients. This year the Symposium will be in Seville, hosted by José Garnacho.

In recent years, physicians providing care in the intensive care unit have seen rapidly increasing rates of microbial antibiotic resistance. Given a concurrent paucity of new antimicrobial agents, more emphasis needs to be placed on:
- preventing ventilator associated pneumonia
- improving our ability to definitively diagnose ventilator associated pneumonia
- improving our knowledge on the innate lung immunity to respond to severe pulmonary infections, and
- incorporating this information into evidence-based guidelines.

The sessions on pulmonary infections and treatment prophylaxis will introduce participants to the latest developments in these areas.

Sepsis-induced organ dysfunction is a leading cause of death in intensive care units, and tissue hypoxia (shock) is a putative cause. However, new evidence indicates that cytopathic events, including DNA and proteins, undermine cell and organ dysfunction in the context of sepsis. Organ damage, in turn, resonates with the immune and endocrine systems to perpetuate sepsis-induced organ dysfunction. The sepsis session will highlight the latest insights into the mechanisms of sepsis-induced organ dysfunction and will consider the therapeutic implications and the genetic influence on outcome. Optimal fluid and catecolamine therapy and the use of steroids in patients with sepsis will be discussed.

At the conclusion of the symposium, participants will be able to:
- describe historic trends in microbial antibiotic resistance and the attendant implications for patients with ventilator associated pneumonia
- identify novel VAP prophylaxis measures currently being developed
- assess the utility of biomarkers in definitively diagnosing VAP
- improve the treatment and outcome of severe community acquired pneumonia
- assess the usefulness and limitation of haemodynamic and microcirculatory alterations during fluid and vasoactive drugs challenge
- decide which of the available fluids and pharmacologic treatments to use by integrating considerations of scientific rationale, effectiveness, outcome studies and cost.

This year we have developed a variety of pre-Symposium Educational Sessions, workshops, meetings on trials and studies, and a consensus conference with a task force of experts. We recommend that you plan to arrive in Seville on Thursday 2nd February, to attend any of these meetings and maximize your educational experience.

Seville is rich in culture, history and architecture. Come to enjoy the art and antiques, Flamenco dancing, the natural park of Coto de Doñana, and the Guadalquivir river.

Join us in Seville!

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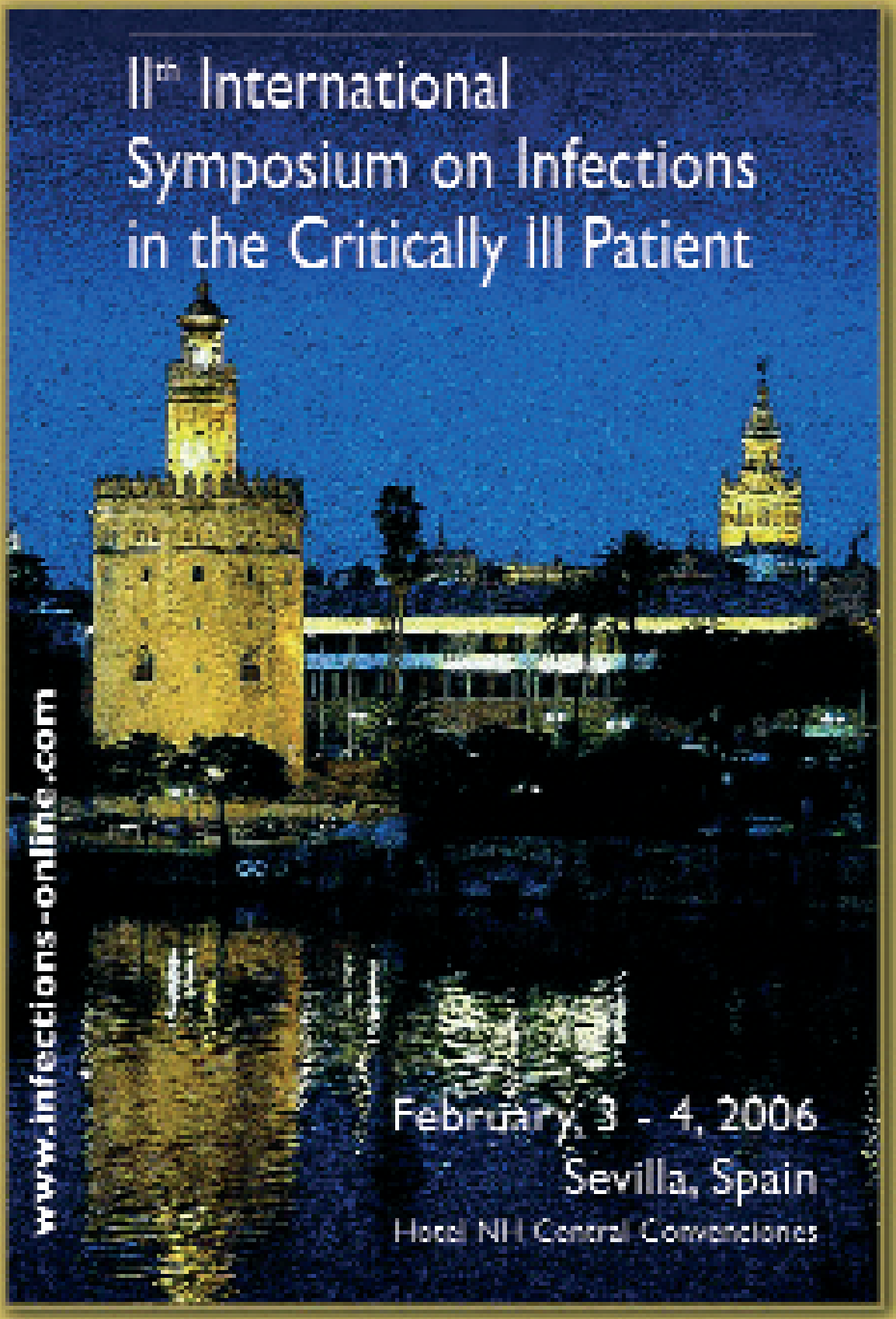
IIth International Symposium on Infections in the Critically Ill Patient



www.infections-online.com

February, 3 - 4, 2006

Sevilla, Spain

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Technical Secretariat Information

McCANN MEETINGS

AGENDA

JANUARY 2006

7-11 35th Critical Care Congress of the SCCM
San Francisco, USA
www.sccm.org

FEBRUARY 2006

3-4 11th International Symposium on the Critically Ill Patient
Seville, Spain
www.infections-online.com

MARCH 2006

21-24 26th International Symposium on Intensive Care and Emergency Medicine
Brussels Belgium
www.intensive.org

24-28 International Anaesthesia Research Society 80th Congress
San Francisco USA
www.iars.org

MAY 2006

10-13 8th Scientific Congress of European Resuscitation Council
Stavanger Norway
http://congress.erc.edu/

13-17 Australian and New Zealand College of Anaesthetists (ANZCA) Annual Scientific Meeting
Adelaide, South Australia
www.sapmea.asn.au/conventions/anzca/index.htm

23-24 UK Intensive Care Society Annual Spring Meeting
Harrogate UK
www.ics.ac.uk

JUNE 2006

3-6 Euroanaesthesia
Madrid Spain
www.euroanesthesia.org

SEPTEMBER 2006

2-6 European Respiratory Society 2006 Annual Congress
Munich Germany
www.ersnet.org/ers/default.aspx?id=2078

24-27 19th Annual Congress of the European Society of Intensive Care Medicine
Barcelona Spain
www.esicm.org

OCTOBER 2006

12-15 31st Australian & New Zealand Annual Scientific Meeting on Intensive Care
Tasmania Australia
www.anzics.com.au

Letters to the Editor & Requests for References cited in ICU Management: editorial@icu-management.org

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